



Newsletter

Winter 2014

AARMS Summer School 2014

The thirteenth annual AARMS Summer School will be held at Dalhousie University from July 21 to August 15, 2014. The summer school is intended for graduate students and promising undergraduate students from all parts of the world. Each participant is expected to register for at least two of the four courses. Each course consists of five ninety-minute lecture sessions each week. These are graduate courses approved by Dalhousie and we will facilitate transfer credit to the extent possible. Tuition and accommodation charges are covered by AARMS, but students must find their own funds for travel expenses. The courses offered in 2014 will be:

Gröbner Bases in Commutative Algebra

Instructor: Dr. Giulio Caviglia, Purdue University

Homological Conjectures in Commutative Algebra

Instructor: Dr. Hailong Dao, University of Kansas

Statistical Learning with Big Data

Instructors: Drs. Hugh Chipman, Acadia University and Xu (Sunny) Wang, St. Francis Xavier University

Spatial Statistics

Instructor: Dr. Julie Horrocks, University of Guelph



In the foreground the historic Chase Building, home of the Department of Mathematics and Statistics and site of the Summer School at Dalhousie.

The deadline for applications is March 15, 2014. For more information, visit our website or contact the Summer School Directors, Dr. Sara Faridi (faridi@mathstat.dal.ca), Dr. Hong Gu (hgu@mathstat.dal.ca).
www.aarms.math.ca/summer

Collaborative Research Group in Numerical Analysis and Scientific Computing

The AARMS funded Atlantic Collaborative Research Group in Numerical Analysis and Scientific Computing (<http://www.math.mun.ca/anasc/>) was formed in 2013 to support the increasing activity in numerical simulation and the design and analysis of numerical algorithms.

The work of the group is driven by the need for the efficient implementation of numerical approximation to today's ever-complex models of realistic scenarios. The group leverages existing expertise in the field in Atlantic Canada as well new hires at Memorial arriving in 2014 and a newly announced Tier II CRC position which will be advertised shortly.

The first major activity of the CRG will occur from August 17-22, 2014 at Memorial. This novel workshop "Recent Development in Adaptive Methods for PDEs" (<http://www.math.mun.ca/anasc/workshop.html>) will bring together students, experts in adaptive methods as well as applied and industrial researchers with a need for efficient numerical simulations. The workshop will have three major components: a short course on adaptive methods taught by Dr. Weizhang Huang from the University of Kansas, research level talks given by invited experts in adaptive methods as well as applied researchers outlining their problems of interest, and finally an interactive session pairing the applied researchers with the adaptivity experts to begin the process of introducing these advanced techniques into their simulations.

In 2015 a similar workshop is planned on domain decomposition methods for PDEs - a divide and conquer technique which allows the numerical computation to be split across many processors or computer cores.

Jacques Guigné awarded Doctor of Science

The chair of the AARMS Board, Jacques Guigné has been awarded the degree of Doctor of Science from the University of Bath. The award was based on a thesis representing a collection of Dr. Guigné's published acoustic in the seabed works and concepts in physics. This is the first such degree to be conveyed for physics at the University of Bath.

News

More Recognition for Donald Violette



After an invitation and a solid interview, Professor Donald Violette has been chosen as a Super Professor for Faculty Row's Network. Super Professors are a peer reviewed group of expert academics that consistently demonstrate excellence, passion, and clarity. Super Professors is recognized by traditional academic institutions as well as several emerging technology entities looking to change the landscape of academia.

Many Individuals have begun acknowledging Super Professors as independent thought leaders.

More recognition comes from the newspaper "L'Étoile", which has chosen Dr. Violette as the personality of the year 2013 in the Restigouche edition. According to journalist Michel Gourd,

"Professeur de mathématiques à l'Université de Moncton, Donald Violette mène depuis déjà plusieurs années une véritable croisade pour améliorer les compétences des étudiants du Nouveau-Brunswick dans son domaine d'expertise. C'est pour cette implication totale qui l'amène à payer de sa poche des frais liés à ses camps mathématiques qu'il a été choisi la personnalité de l'année 2013."

AMS Eastern Sectional Meeting at Dalhousie

Dalhousie University will host the American Mathematical Society Eastern Sectional Meeting on October 18-19, 2014. The meeting will consist of up to 20 special sessions, as well as four invited addresses by François Bergeron (UQAM), Sourav Chatterjee (NYU), William M. Goldman (U. Maryland), and Sujatha Ramdorai (UBC).

Potential special session organizers should contact Peter Selinger for details. Although the initial deadline has passed it may still be possible for researchers from Atlantic universities to organize special sessions.



left to right: Bergeron, Chatterjee, Goldman and Ramdorai

The full program of events can be found at:
http://www.ams.org/meetings/sectional/2223_progfull.html

Recent Developments in Adaptive Methods for PDEs: AARMS-CRM Collaborative Workshop and Short Course

Second Call for Participation in: "Recent Developments in Adaptive Methods for PDEs" AARMS-CRM Collaborative Workshop and Short Course, organized by the Atlantic Association for Research in the Mathematical Sciences (AARMS) Collaborative Research Group in Numerical Analysis and Scientific Computing, Aug. 17- 22, 2014, St. John's, NL, Canada. This workshop is a collaborative initiative of the Centre de Recherches Mathématiques (CRM) and AARMS.

The aim of this workshop is to provide an introduction to the state of the art in theory and practical applications of adaptivity in PDEs. The program will begin with a two-day short course, "Adaptive Methods for the Numerical Solution of PDEs", given by Dr. Weizhang Huang (University of Kansas). The middle component of the program will focus on presentations by researchers whose work may benefit from the use of adaptive techniques for PDEs arising as mathematical models in practical applications. The final segment of the program will feature a workshop format in which breakout teams, consisting of graduate students and postdoctoral fellows led by experts on theoretical or computational aspects of adaptive methods for PDEs, will investigate the process of introducing adaptive techniques into the numerical simulations that arise in the applications identified earlier. The segment will also include several talks by researchers working in adaptivity for PDEs.

There are 3 ways to participate:

- attend the short course and workshop!
- present an academic or industrial applied problem which may benefit from the use of adaptive PDE techniques
- present recent research results on adaptive methods for PDEs and work on the collaborative workshop teams

Registration is required. Partial travel support is available. Further details and registration information are available at www.math.mun.ca/anasc/workshop.html.

Email: rhaynes@mun.ca for more information.

Call for Proposals

We encourage mathematicians in Atlantic Canada to submit proposals for funding for workshops, conferences, outreach projects, etc to our Online System. The next deadline for submission: May 15, 2014. For more details please visit www.aarms.math.ca/events

An AARMS Postdoc Reports



My name is Yuzhao Wang. I am an AARMS postdoctoral fellow at Memorial University of Newfoundland in the Department of Mathematics and Statistics. My host professor is Jie Xiao. I obtained my PhD in pure Mathematics at Peking University in Beijing, China. My advisers at Peking University were Baoxiang Wang and Zihua Guo. I spent one year at

the University of Chicago in the Department of Mathematics during my doctoral program as a joint education student, with supervisor Carlos E. Kenig. Before I came to St. John's, I was an associate professor at North China Electric Power University in Beijing, China.

I am working on Partial differential equations, which is a broad field related to mathematics, physics and even social sciences such as finance. Most of my research by now is related to nonlinear dispersive equations, while the dispersive equations are part of partial differential equations that are dispersive, which means that waves of different wavelength propagate at different phase velocities, and the nonlinear dispersive equation is the dispersive equation with nonlinear terms and thus the solution map is nonlinear. Most dispersive equations satisfy some conservation laws, such as mass or energy conservation law. The nonlinear dispersive equations contain lots of famous models coming from physics, such as the Schrödinger equation, Korteweg–de Vries (KdV) equation, wave equation and Einstein equation. For an initial value problem (IVP) of dispersive equations, we are concerned with the local well-posedness (LWP): Does this equation have a unique solution local in time, continuously depending on the initial data? Global well-posedness (GWP): Does the local solution extend to any large time? And long time behavior: Does the solution scatter or blow up at some time?

One of my most recent works is on the (IVP) of nonlinear Schrödinger equation (NLS) on irrational tori. The IVP of NLS on Euclidean space has been studied extensively and well-understood over recent years: the main tool is the Strichartz estimate, which is a dispersive estimate that relies on the decay nature of the Schrödinger equation on Euclidean spaces. But when the context is a compact manifold, there is no decay at all, and the problem becomes much more difficult and much less is known. One way out is combining the tools from number theory, such as a divisor counting argument and the Hardy-Littlewood circle method, and the Tomas-Stein restriction method from harmonic analysis, Bourgain and others obtain partial Strichartz estimate of linear Schrödinger equation on standard tori or even Zoll manifold, i.e. a compact Riemannian manifold such that all geodesics are simple and closed with a common minimal period. Bourgain's argument can be easily generalized to all rational tori, i.e. on which the period of the function at every direction has one common period. But things are very different on irrational tori, the main difficulty is that there is no common major arc decomposition since there is no

difficulties by introducing in some new ideas and modifying the previous arguments. On one hand, we improved the known results on Strichartz estimate, especially in 2 dimensions; there was no sharp estimate before our work. On the other hand, we obtained some subcritical and critical local well-posedness results for NLS on irrational tori. The method used here only exploits a little information from the context manifold, so it is believed that it could be applied to a more general manifold.

Math Outreach in New Brunswick: STEM Expo 2014

The local STEM Expo was held Saturday, March 15, 2014 at Bliss Carman Middle School in Fredericton. Ryan Jones and I organized an array of games and challenges in a recreational mathematical exhibit of sorts. This effort was enriched with the valuable support of three UNB Education students, namely, Julie Glaspy, Maggie Parkin, and Jacinda Hallihan. All hands were needed as approximately 200 children and adults engaged with math through the morning and early afternoon. Six tables of mathematical activities were set up along the perimeter of a gym otherwise dominated by science fair projects. The neighbouring exhibit of UNB Math and Statistics, hosted by Patrick Reynolds, added probability and geometry models to the mix.

A popular challenge involved placing three $1 \times 1 \times 1$ and six $2 \times 2 \times 1$ pieces into a $3 \times 3 \times 3$ cube. Perhaps the most intriguing challenge was the marble puzzle that could be solved by spinning the wooden model, thus, putting the marbles into holes at opposite ends. (These puzzles appear in the photo with Madison and Samara, two sisters who played many games.) Another example of a challenge featured a collection of interlocking cubes. An open invitation was extended to create heptominoes that would not be congruent to any others on the table.

One benefit of local outreach efforts (supported by AARMS since 2010) was evident as some parents, teachers, and students expressed appreciation beyond the moment itself. That is, their experiences built upon existing connections from previous school visits or events.

What's next? As usual an effort is made to extend outreach to schools outside of Fredericton in the spring. Full day school visits are planned for Cambridge-Narrows (Apr. 3), Fredericton Junction (Apr. 4) and Harvey (Apr. 10).

- John McLoughlin



Sisters Madison and Samara enjoying math games in Fredericton

Recent and Upcoming Events

Combinatorial Algebra meets Algebraic Combinatorics

Organizers: Sara Faridi, Hugh Thomas, Mike Zabrocki
Location: Dalhousie
Date: January 24-26, 2014
Contact Information: Hugh Thomas

UPEI/CMS Math Camp

Organizer: Ken Sulston, Nasser Saad
Location: University of Prince Edward Island, Charlottetown
Date: May 2-4, 2014
Contact Information: Ken Sulston

Atlantic General Relativity 2014

Organizers: Sanjeev Seahra, Jack Gegenberg
Location: University of New Brunswick (Fredericton)
Date: May 6-7, 2014
Contact Information: Sanjeev Seahra

STFX/CMS Math Camp

Organizer: Joe Apaloo, Karyn McLellan, Ping Zhou
Location: St. Francis Xavier University, Antigonish
Date: May 16-18, 2014
Contact Information: Joe Apaloo

Two weeks at WATERLOO - A Summer School for Women in Math

Organizers: B. Csima et al
Location: University of Waterloo
Date: August 10-23, 2014
Contact Information: Barbara Csima

Canadian Conference on Computational Geometry

Organizers: Norbert Zeh, Meng He
Location: Dalhousie University
Date: August 11-13, 2014
Contact Information: Norbert Zeh

Recent developments in the adaptive solution of PDEs

Organizers: Ronald Haynes, Paul Muir, Hermann Brunner
Location: Memorial University, St. John's
Date: August 17-22, 2014
Contact Information: Ronald Haynes

The Coast to Coast Seminar Series

Lectures on topics from Mathematics and Computer Science
Location: In the Videoconferencing facility of your university
Date: Every Second Tuesday at 3:30pm (AST) during term time
More details: visit the Coast to Coast Seminar Page

AARMS is proud to sponsor high-quality activities in Atlantic Canada which significantly enhance research and the training of graduate students.

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Perfect numbers, like perfect men, are very rare.

~René Descartes