



# Newsletter

Summer 2012

## SIAM Meeting on Discrete Mathematics

On June 18-22, Dalhousie will host the biannual SIAM meeting on Discrete Mathematics (SIAM-DM). The meeting is expected to attract about 350 discrete mathematicians. The members of Dalhousie's Graphs & Games group, Jason Brown, Jeannette Janssen and Richard Nowakowski, are the local organizers, and all students and post-docs of the group will help out.

The meeting will have plenary lectures by internationally renowned discrete mathematicians, as well as 8 concurrent sessions of minisymposia. The talks cover a wide range of topics, ranging from pure to applied, and having links with algebra, topology, applied math, and computation. For example, the invited talk by Anders Björner, chaired by Dr. Brown, is about how cell complexes, known from topology, can be applied to combinatorial structures. The invited talk by Balázs Szegedy, chaired by Dr. Janssen, discusses the application of tools from analysis and probability theory to find relationships between subgraph counts in graphs.

The Dénes König prize lecture will be held on the evening of the first day, June 18, followed by a welcome reception. The lecture will be given by Zeev Dvir from Princeton University. The talk will describe the speaker's proof of a conjecture about the finite field Kakeya problem, which asks what is the size of the smallest set in  $F^n$ , where  $F$  is a finite field, that contains a line in every direction. In 1996, Wolff conjectured that such sets must have size at least  $c|F|^n$ , with  $c$  a constant depending only on  $n$ .

The Atlantic combinatorics community actively participates in the meeting. Dr. Brown is organizer of, and speaker in, a minisymposium on Combinatorial Polynomials. Dr. Janssen, together with Lata Narayanan from Concordia University, organizes a minisymposium on geometric graphs. David Pike from Memorial organizes a (four part) minisymposium on Design Theory. Nancy Clarke from Acadia and Shannon Fitzpatrick from UPEI are speaking in a minisymposium on Cops and Robber Games on Graphs. Also, Penny Haxell, new member of the AARMS Scientific Review Panel, organizes a minisymposium on Extremal Graph Theory.

On Wednesday evening, there will be a forward looking session, with four panelists. Finally, there will be two smaller workshops to follow the meeting: Dr. Nowakowski is hosting a workshop in combinatorial game theory, and Dr. Janssen is co-

organizing, with Anthony Bonato, the 9th Workshop on Algorithms and models for the Web graph (WAW 2012). The web site for the SIAM meeting is <http://www.siam.org/meetings/dm12/>.  
- Jeannette Janssen

## Theodore Kolokolnikov awarded 2012 CAIMS/PIMS Early Career Prize

The 2012 CAIMS/PIMS Early Career Award in Applied Mathematics has been awarded to Prof. Theodore Kolokolnikov of Dalhousie University. Prof. Kolokolnikov has been given this award for his highly influential contributions to the study of pattern formation in systems governed by nonlinear differential equations.



Prof. Theodore Kolokolnikov is a versatile researcher who has made significant contributions to the study of phenomena modeled by nonlinear differential equations. He uses a wide range of mathematical techniques including asymptotic methods, PDE theory, complex analysis, dynamical systems, special functions, and scientific computation. He combines these diverse tools in novel ways to derive precise, quantifiable predictions about the shape and dynamic behaviour of solutions of differential equations. His work is motivated by and has wide applications to the natural sciences. These include such varied topics as models of laser fusion, patterns in chemical reactions, phytoplankton distribution in oceans, hot spots in microwave heating, models of crime, cell aggregation in chemotaxis, and biological swarming.

Prof. Kolokolnikov obtained his PhD from University of British Columbia in 2004. He held postdoctoral positions at University of Brussels and at Chinese University of Hong Kong. He joined Dalhousie University in 2006, where he is currently an Associate Professor. The award consists of a cash prize of \$1,000 and a commemorative plaque that will be presented at the CAIMS Annual Meeting in Toronto in June 2012. Prof. Kolokolnikov will deliver a plenary lecture at the meeting as part of the award ceremony.

- article and photo courtesy of PIMS

# News

## An AARMS Postdoc Reports

My name is Ryan Tifenbach and I am a post-doctoral fellow at the Memorial University of Newfoundland. My education has been an exciting journey – I received a bachelor's degree in honours mathematics at the University of Victoria, a master's degree in pure mathematics at the University of Regina and, most recently, I successfully defended my doctoral thesis at the National University of Ireland Maynooth.



My doctoral research is entitled “A combinatorial approach to nearly uncoupled Markov chains”. Imagine some very large network or graph; we refer to this network as nearly uncoupled if its nodes can be partitioned into two or more disjoint sets, referred to as aggregates, such that the nodes in a single aggregate are very well-connected and the nodes in distinct aggregates are very poorly connected. In broad terms, we consider nodes to be well-connected if there are a significant number of short paths joining them, and poorly connected otherwise. The topic of my thesis was an attempt to solve, via algorithm, the following problem: given such a network, where the aggregates are unknown, can we construct these well-connected aggregates in an efficient manner (time-wise)?

The basic tool applied was a concept from probability theory known as a stochastic complement. The stochastic complement is a method by which a random process on a state space  $X$  can be reduced to a random process on a proper subset of  $X$  while altering as little as possible the fundamental properties of the original process.

We then consider the random walk on the network, which is exactly as it might sound – we imagine a “wanderer” roaming around the network, traversing its nodes via the connections/edges between them. We view two locations within the network as well-connected if the probability of visiting one and then the other in quick succession is relatively high. Once we have identified two such locations as well-connected, we “edit” one of them out, using the stochastic complement. In this manner, a partition is constructed by examining smaller and smaller networks, without ever having to examine the dynamics of the entire random walk. This inductive construction can be carried out in polynomial time ( $n^3$ , where  $n$  is the number of nodes in the network) and has proven to be very competitive with alternate approaches.

I am interested in developing applications of this construction; specifically, this approach seems to have potential use as the core of a recommendation system. A recommendation system is some method of recommending entries from a database or a catalogue to its users, based on their activities. For example, a well-known recommendation system is in use by Amazon; as users browse their online store, further products are recommended to them based on their

purchases and activities on the site.

I am very pleased by the opportunity, made possible by the AARMS post-doctoral fellowship, to find work here in Newfoundland. I have never visited Atlantic Canada before now, and have found research at the Memorial University and living in St. John's to be a very rich new experience.

- Ryan Tifenbach

## Moncton and Vietnam Collaborate on Statistics Conference

For the celebration of 2013 as the International Year of Statistics, the University of Moncton (Canada), together with The Natural Sciences University of Hochiminhcity, Ton Duc Thang University and Can Tho University, all located in VietNam, will organize an INTERNATIONAL CONFERENCE entitled : Statistics and its Interactions with Other Disciplines on May 29-31, 2013, in Hochiminh City, VietNam.

The conference goal is to provide a forum for all researchers working in the Statistical science field itself, or in any discipline using statistical methods, to present their work, and get to know other researchers so as to broaden their views of Statistics, in the spirit of the celebration. In particular, a special part of the conference will be devoted to teaching statistical methods within different disciplines. All researchers and their collaborators are invited. Contacts: phamgit@umoncton.ca, or cdkhanh@itam.tdt.edu.vu

## News from UPEI

Lowell Sweet retired this past year after a long and distinguished career at UPEI. Dr. Sweet was a popular teacher of mathematics and has remained active in research, even after retirement. A research collaborator of his, Dr. Jim MacDougall (Newcastle), who was once a faculty member at UPEI and was a frequent visitor to our Department, also retired this past year. Drs. Sweet, MacDougall and myself (all Maritimers) recently published a paper on the dimension of subspaces of nilpotent matrices.

The Department has welcomed Dr. Shafiqul Islam as Dr. Sweet's replacement. Dr. Islam has been with our Department for a few years on a term position and works in Dynamical Systems and Financial Mathematics. I was recently elected as Chair of the Science Atlantic Math&Stats committee.

Our students have had many notable recent achievements. Runmin Shi received the Governor General's medal for top undergrad student at the Spring Convocation. UPEI's Putnam Competition Team was an officially ranked team, with one student, Sam Arnold, finishing in top 5%. UPEI held its 8th annual Math Camp for High Schools in May. It has become a very popular event among students. This year there were sessions on: The number  $i$ , Mathematical card tricks, Instant insanity, The golden ratio and other topics.

In less pleasant news, Mathematics and Statistics was hit hard in the recent Budget at UPEI. A position in Statistics was cut, and the Math Help Centre was significantly curtailed.

- Gordon MacDonald

## News from Mount Allison

At the end of June 2012, Margaret Beattie retired from the Department of Mathematics & Computer Science and Ron Beattie transitioned into a phased retirement. They will both be greatly missed by faculty, staff, and students of Mount Allison. The Department will be welcoming Geoff Cruttwell as Ron's replacement. Geoff completed his Ph.D. at Dalhousie University in 2009 and has since held post-doctoral positions at the University Calgary and the University of Ottawa.

Earlier this year, Andrew Irwin joined 22 other scientists on a six-week mission in the West Antarctic Peninsula, researching bacteria, phytoplankton, zooplankton, krill, penguins, and whales. The NASA-funded study centres on using statistical models to connect satellite data to observations of penguin foraging patterns, temperature, sea ice, and other variables.

In February, Dr. John Mighton visited Mount Allison as part of the President's Speakers Series in the Year of Science and Discovery. He is a playwright, mathematician, educator and the founder of JUMP (Junior Undiscovered Math Prodigies).

- Margaret-Ellen Messinger



*Andrew Irwin in Antarctica posing with some difficult students*

## Spring at the Atlantic Algebra Centre

The XII AAC mini course "Non-commutative Cryptography" was given by Professor Vladimir Shpilrain (City College of New York, NY, USA) on February 26 - March 3, 2012. The mini course was attended by the students and faculty interested in applying methods of pure Algebra for the solution of practical problems in Cryptography. It was also attended by the students of the graduate course "Group Theory" given by Dr Mikhail Kochetov. As a result, the materials of the course have been used in the final presentation of these students. The notes of the lectures are available on the website of Atlantic Algebra Centre <http://www.mun.ca/aac/AACMiniCourses/VladSpielrein/>

The XIII AAC mini course "Growth of Groups and Related Topics" was given by Professor Rostislav Grigorchuk (Texas A & M University, USA) on May 6 - 12, 2012. The audience of the workshop had numerous discussions with Professor

Grigorchuk after lectures in the office of AAC and elsewhere, in particular during several sightseeing trips during this iceberg season on Newfoundland. Professor Grigorchuk learned about the results in the Geometric and Combinatorial Group Theory obtained by the students and faculty of MUN and provided invaluable advice for the future research. One of the participants of the mini course, Gaelan Hanlon came from the University of New Brunswick – Fredericton. His trip was partially covered from the funds of AAC. At this time an USRA student Jonny Lomond is preparing Professor Grigorchuk notes for the publication on the web site of AAC.

The VII AAC International Workshop "Groups, Rings, Lie and Hopf Algebras III" will be held at Bonne Bay Marine Station of Memorial University of Newfoundland in Norris Point, NL, from August 12 - 18, 2012. The participants of the workshop come from 10 countries, including Argentina, Australia, Brazil, Belgium, Canada, Israel, Italy, Poland, Spain, and the United States. A particular feature of this workshop is that for the first time of AARMS Summer Schools it provides a follow-up to a Summer School to be held at Memorial University in July - August 2012. Seven students of the School will be attending the Workshop, most will present a short research talk.

In March, we conducted our Sixth Undergraduate Algebra Competition for the students of the universities of Atlantic Canada. The winners are Gaelan Hanlon from the University of New Brunswick – Fredericton and Jonathan Lomond from Memorial University. They have been awarded book prizes.

- Yuri Bahturin

## New Brunswick Math Competition

The 30th annual New Brunswick Mathematics Competition for grades 7-9 was held on May 11th, 2012, simultaneously on the campuses of the University of New Brunswick at Fredericton and Saint John, and at l'Université de Moncton at Moncton, Edmunston, and Shippagan. The competition paper was available in both English and French at all locations. A total of 1188 students participated, representing 152 schools from all 14 school districts.

The competition also provided a valuable opportunity for interaction between universities and schools. Teachers met with competition coordinators while their students were busy solving problems during the morning. While students awaited the competition results in the afternoon, both students and teachers enjoyed tours and demonstrations at various university facilities. The competition rewards students for academic excellence.

Sponsors included the NB Department of Education, CMS, AARMS, Morneau Shepell, CIBC Wood Gundy, IA Clarington, and the two host universities. Many faculty, staff, and students at all five campuses helped out on the day of the competition and the awards ceremony at UNB-Fredericton was hosted by Dr. Eddy Campbell, mathematician and President of the University of New Brunswick.

More information can be found at: <http://www.math.unb.ca/mathcomp/>

# Recent and Upcoming Events

## Workshop on Algorithms and Models for the Web Graph

Organizer: Jeannette Janssen  
Location: Dalhousie University, Halifax  
Date: June 21-22, 2012  
Contact Information: Jeannette Janssen

## Combinatorial Games Workshop

Organizer: Richard Nowakowski  
Location: Dalhousie University, Halifax  
Date: June 22-26, 2012  
Contact Information: Richard Nowakowski

## 14th Cdn Conference on General Relativity and Relativistic Astrophysics (CCGRRR 14)

Organizers: Ivan Booth, Hari Kunduri, Benjamin Tippett  
Location: Memorial University, St. John's  
Date: July 9-12, 2012  
Contact Information: Ivan Booth

## International Symposium in Statistics

Organizer: Brajendra Sutradhar  
Location: Memorial University, St. John's  
Date: July 16-18, 2012  
Contact Information: Brajendra Sutradhar

## 24th Canadian Conference on Computational Geometry

Organizers: Greg Aloupis and David Bremner  
Location: Memorial University, Saint John's  
Date: August 8-10, 2012  
Contact Information: Greg Aloupis

## Groups, Rings, Lie and Hopf Algebras III

Organizer: Yuri Bahturin, Mikhail Kotchetov  
Location: Memorial University, Bonne Bay Marine Station  
Date: August 12-18, 2012  
Contact Information: Yuri Bahturin

## Workshop on Mathematical Biology

Organizers: David Iron, Theodore Kolokolnikov, James Watmough, Sina Adl  
Location: Dalhousie University  
Date: August 18-19, 2012  
Contact Information: David Iron

## Atlantic Conference on Dynamical Systems

Organizers: Alan Coley, David Iron, Theodore Kolokolnikov  
Location: Dalhousie University  
Date: August 20-22, 2012  
Contact Information: Alan Coley

## Noncommutative Geometry

Organizers: Colin Ingalls, N. Higson, M. Lesch, B. Rangipour  
Location: University of New Brunswick, Fredericton  
Date: August 25 - Sept 5, 2012  
Contact Information: Colin Ingalls

## 2012 Science Atlantic Mathematics, Statistics and Computer Science Conference

Organizers: Robert Rosebrugh, M. E. Messinger, A. Hamilton-Wright  
Location: Mount Allison University, Sackville  
Date: October 12 - 13, 2012

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*To parents who despair because their children are unable to master the first problems in arithmetic I can dedicate my examples. For, in arithmetic, until the seventh grade I was last or nearly last.*  
~Jacques Salomon Hadamard