



**DALHOUSIE  
UNIVERSITY**

**CHASE REPORT**

Department of Mathematics and Statistics

June 2016

# CONGRATULATIONS

## AWARD WINNERS

### University Silver Medal

*Hayley Tomkins*

### Sir William Young Gold Medal in Mathematics

*Hayley Tomkins*

### University Medal in Statistics

*Grace Liu*

### University Medal in Actuarial Science

*Dimitri Duncombe*

### Ralph & Frances Lewis Jeffery Scholarship

*Hayley Tomkins  
And  
Emma Carline*

### Barry Ward Fawcett Memorial Prize

*Curran McConnell*

### Ken Dunn Memorial Prize

*Jordan Barrett*

### Katherine M. Buttenshaw Prize

*Josh Feldman*

### Waverly Prize

*Sarah Macneil*

### Emil and Stella Blum Award in Mathematics

*Stephanie Clay*

### Ellen McCaughin McFarlane Prize

*Finlay Rankin*

### Professor Michael Edelstein Memorial Graduate Prize

*Melissa Huggan*

### Heller-Smith Scholarship

*Kim Whoriskey*

### Field Prize in Statistics

*Xin Yue Zhang*

### Geddes Fillmore Award

*Jeremy Peters*

### Peter and Ann-Ellen Fillmore Scholarship in Math

*Jennifer Dumont*

### Undergraduate Research Awards

*Amir Farrag (Rob Milson)  
Emma Carline (Keith Taylor)  
Josh Feldman (Jeannette Janssen)  
Jordan Barrett (Richard Nowakowski)*

**HONOURS STUDENTS****Honours - Mathematics**

*Hayley Tomkins*  
*Hector MacRury*  
*Anne Johnson*  
*Brandon Elford*  
*Emma Carline*  
*Nicolas Banks*  
*Joshua Gummatt (Honours Conversion)*  
*Scott Cameron (Honours Conversion)*  
*Spencer Farrell (with Physics)*  
*Zipeng Lin (with Economics)*  
*Paul-Christopher Chavy-Waddy (with Economics)*  
*Dimitri Duncombe (with Actuarial Science)*  
*Nicole Yannsah (with Economics)*  
*Iris Dockrill (with Economics)*  
*George Ambrose (with Physics)*

**Honours - Statistics**

*Weisi Si*  
*Yiqun Liu*  
*Maggie-Jane Parker (with Psychology)*  
*Jad Sinno (with Neuroscience)*  
*Cathleen Dai (with Microbiology and Immunology)*  
*Jennie Korus (with Marine Biology)*

**NSERC AWARD WINNERS**

|                |                       |
|----------------|-----------------------|
| <b>CGS – M</b> | <i>Emma Carline</i>   |
| <b>CGS – M</b> | <i>Mary Brown</i>     |
| <b>CGS – M</b> | <i>Kyle MacKeigan</i> |
| <b>PGS – D</b> | <i>Melissa Huggan</i> |

**NEW KILLAMS**

*Melissa Huggan*

**KILLAM RENEWALS**

*Svenja Huntemann*  
*Antonio Vargas*  
*Kim Whoriskey*  
*Xiaoning Bian*  
*Darien DeWolf*

**PRESIDENT'S AWARD**

*Melissa Huggan*

**GRADUATE STUDENTS****October 2015 Convocation:****Mathematics**

*Aysel Erey, PhD*  
*Nursel Erey, PhD*  
*Christopher Levy, PhD*  
*Neil Ross, PhD*  
*Benjamin Hersey, MSc*  
*Douglas Staple, MSc*

**May 2016 Convocation:****Mathematics**

*Ali Alilooee Dolatabad, PhD*  
*Lucas Mol, PhD*  
*Elham Roshanbin, PhD*  
*Chunyi Gai, MSc*  
*Kunpeng Wang, MSc*

**Statistics**

*Robert Dexter, MSc*  
*Yihao Yin, MSc*

## CHAIR'S MESSAGE

by Bruce Smith

Congratulations to all of our graduates. Convocation Day is a special time to celebrate your hard work and achievements. Special congratulations to those of you who have distinguished yourselves through receipt of honours and prizes.

Departmental Congratulations:

- to **Hong Gu** and **Dorette Pronk**, who were recently promoted to Full Professor
- to **David Iron** and **Keith Johnson** on the successful renewal of their NSERC Discovery grants
- to the following individuals, who this year will receive Dalhousie long service awards: **Andrea Fraser** (15 years), **Dorette Pronk** (15 years), **David Hamilton** (35 years), and **Pierre Stevens** (35 years)
- to **Robert Milson**, who with co-authors was awarded the 2016 Journal of Physics A: Mathematical and Theoretical Best Paper Prize, for their paper "*Rational extensions of the quantum harmonic oscillator and exceptional Hermite polynomials*"

Upcoming events:

Following are some of the upcoming mathematical events at Dalhousie, including names of co-organizers.

June 9 – Eastlink event for Math Circles (see the Math Circles report) (**Svenja Huntemann**)

June 10-12 – Integrated Function Systems, Fractals and Invariant Measures Conference (**Dorette Pronk**)

June 23-24 - Atlantic General Relativity Conference and Workshop (**Alan Coley**)

July 3-8 – Canadian Mathematical Society Math Camp (**Roman Smirnov, Marie-Andree B Langlois**)

July 4 – 10 – AARMS Summer School preparation week (**Dorette Pronk**)

July 9-14 – Black Educators Association Math Camp (**R.P. Gupta**)

July 11 – Aug 5 – AARMS Summer School (**Dorette Pronk**, Geoff Cruttwell [Mt. Allison])

Aug 7 – 13 – International Category Theory Conference (**Dorette Pronk**, Geoff Cruttwell [Mt. Allison])

Aug 8/16 – Distinguished Lecture Series Lecture: Jamie Vicary, University of Oxford. Topic: Quantum computing (Departmental committee)

Thanks in particular to **Dorette Pronk** who has taken the lead on organizing this year's AARMS Summer School, together with a number of associated events.

Programs and Curriculum:

Our proposal for a BSc program in Actuarial Science was approved in fall, 2015. Special thanks to **Toby Kenney**, who developed the program proposal, has been teaching the primary curriculum, and supervising honours students in Actuarial Science. Dimitri Duncombe is our first degree recipient in Actuarial Science,

graduating with Combined Honours in Mathematics and Actuarial Science. Congratulations Dimitri.

Our first cohort of 2+2 students in Statistics from Shandong University of Finance and Economics (SDUFE) has just graduated, and another group is entering year four. This fall we expect our first 2+2 students in Mathematics from Tianjin University. Our 2+2 agreement with SDUFE is currently being extended to include Actuarial Science.

Changes:

**Hong Gu** steps down as Director of Statistics on June 30. Hong's notable contributions as Director include the development of the 2+2 programs with Chinese partner institutions in both Mathematics and Statistics, and the successful guidance of our Actuarial Science proposal through Senate.

**Mike Dowd** takes over as Director of Statistics on July 1.

**Keith Johnson** finishes as Mathematics honours advisor on June 30. He will be replaced in that role by Dorette Pronk.

**David Hamilton** will retire on July 1 after a distinguished (and as you will have noted above, long) career in Statistics at Dalhousie. The retirement will be in name only, as David will continue to be active in research and graduate supervision.

**Jeannette Janssen** steps down as Director of the Atlantic Association for Research in the Mathematics Sciences (AARMS) on June 30. During her term as Director, Jeannette was able to secure a substantial increase in AARMS funding from the Government of Nova Scotia. This allowed us to significantly broaden the

outreach activities of the Department, including the hire of **Chris Duffy** as the AARMS outreach postdoctoral fellow. Congratulations, Jeannette, on a job well done with AARMS.

Thanks to the many individuals - students, faculty, and staff – who are responsible for the diverse activities of our department.

Thanks to Angela for her impeccable upkeep of our building, and to Balagopal, who keeps us on top technologically.

Special thanks to Ellen, Maria, and Queena (and Paula prior to her retirement) for keeping me on track, and making my term as Chair such a pleasant one. I am certain that they will do the same for Jeannette, who takes over as Department Chair on July 1.

## MATHEMATICS DIVISION

By Roman Smirnov

My predecessors - **Karl Dilcher** and **Peter Selinger**, who served in the position of Mathematics Director last year, have helped me a great deal during the first year of my directorship with meticulous notes, spreadsheets, various data, and, of course, the "Handbook for the Director of Mathematics" written by Peter. All of these and the overall support from the Division members have helped to continue the steady course of stability that the Mathematics Division was brought to in recent years after some necessary major changes to our programs, such as, for example, the introduction of an Applied Mathematics stream to the Mathematics Honours program.

This year we concentrated on other changes that were aimed to bolster our

existing courses and programs. In particular, **Chris Levy** and **Lucas Mol** have been working on creating online assignments for MATH1000, MATH1010, MATH1115 with the aid of the WebWorks software and developing in collaboration with the Centre for Learning and Teaching an online version of MATH1000. The completion of these and other projects this summer will provide our students from the 2016/17 academic year onwards with a more flexible and efficient learning environment.

**Dorette Pronk** will be the new Mathematics Honours Coordinator. She replaces **Keith Johnson** after Keith's term will have ended on July 1st. **David Iron** will continue his work as the Mathematics Graduate Coordinator next year.

I wish to thank **Bruce Smith** and all of the Division members for their continuous help and support during this year. Last but not least, I am especially thankful to our Departmental Administrator **Queena Crooker-Smith** who has always been doing a fantastic job.

## STATISTICS DIVISION

by Hong Gu

The actuarial science program proposal of "Bachelor of Science with Major, Honours, Combined Honours, Double Major in Actuarial Science and Post-Baccalaureate Diploma in Actuarial Science" was approved by MPHEC on October 28th, 2015. A new calendar entry on all these newly approved programs has been included in the 2016/17 academic calendar. We have the first graduate with a combined Honours in mathematics and actuarial science in this May convocation. Several students qualified for Honours in

either Actuarial science or Statistics, but chose to graduate with Honours in statistics with future further study in Actuarial science.

Most of the ten 2+2 students who entered our program in 2014 have fulfilled all requirements for Major in statistics and are graduating in the May convocation. One Honours student is writing the Honours thesis in the summer term and will graduate in the Oct. convocation. The statistics faculty members have worked hard to help the 2+2 students who have a mainly Economics background to catch up on the course requirements. The experience we have obtained on advising these students is very valuable for the success of future 2+2 students. These students have had a happy journey in Dalhousie University. Most of them will stay for the summer to study several Economics courses to fulfill the requirements of the Economics degrees from Shandong University of Finance and Economics.

**Joanna Mills-Flemming** has taken over the graduate coordinator from **David Hamilton** in July 2015. **Mike Dowd** will replace me as the Statistics director with my term ending on July 1st. I wish Mike Dowd a successful and enjoyable journey in this position.

## AWARDS DAY SPEAKER

**JOSHUA LEON** is the Dean of Engineering at Dalhousie University. He previously was Professor and Head of the Department of Electrical and Computer Engineering at the University of Calgary. Before moving to Calgary, Dr. Leon was a faculty member in the Institute of Biomedical Engineering and the

Department of Electrical and Computer Engineering at the Ecole Polytechnique de Montreal. He earned his BSc and Master's degrees in Mathematics and a PhD in Biophysics all at Dalhousie University. He is a Professional Engineer, a qualification he received through courses and confirmatory exams.

He is a member of Engineers Nova Scotia a Fellow of the Canadian Academy of Engineering and a Fellow of Engineers Canada.

Dr Leon currently serves as a board member of the Halifax Marine Research Institute and Board of the Offshore Energy Research Association of Nova Scotia (OERANS).

Throughout his career Dr. Leon has been an active researcher. He has published over 80 peer reviewed articles on computational science, electromagnetics, bioelectric phenomena and cardiac electrophysiology. His current research focus is on the acceleration of numerical software using Graphics Processing Units (GPU). Dr. Leon is a co-founder of Acceleware, a publicly traded company based in Calgary Alberta. They are the recognized world leader in General Purpose GPU computing.

### **Journal of Physics A recognizes mathematical research excellence**

IOP Publishing has announced the winners of the 2016 Journal of Physics A: Mathematical and Theoretical Best Paper Prize 2016. Three prizes were awarded to the following papers:

"Rational extensions of the quantum harmonic oscillator and exceptional Hermite polynomials"

J. Phys. A: Math. Theor. 47 015203  
David Gómez-Ullate (Instituto de Matemática Interdisciplinar; Instituto de Ciencias Matemáticas)  
Yves Grandati (Université de Lorraine–Site de Metz)  
**Robert Milson** (Dalhousie University)

"High-precision percolation thresholds and Potts-model critical manifolds from graph polynomials"

J. Phys. A: Math. Theor. 47 135001  
Jesper Lykke Jacobsen (LPTENS, École Normale Supérieure; Université Pierre et Marie Curie)

"An integrable deformation of the AdS<sub>5</sub> × S<sup>5</sup> superstring"

J. Phys. A: Math. Theor. 47 495402  
Timothy J Hollowood (Swansea University)  
J Luis Miramontes (Universidad de Santiago de Compostela)  
David M Schmidt (Swansea University; Instituto de Física Teórica IFT/UNESP)

Maggie Simmons, Executive Editor of Journal of Physics A, said: "Since 2009, the Journal of Physics A Editorial Board has awarded a Best Paper Prize to celebrate and applaud well written papers that make a significant contribution to their field. On behalf of the Editorial Board and colleagues here at IOP Publishing, we congratulate all seven authors on winning the prize."

### **Research partnership with Scotiabank through NSERC Engage.**

Each year, the Natural Sciences and Engineering Research Council of Canada (NSERC) awards 200 Engage Grants across Canada. NSERC Engage Grants are designed to give innovative companies that operate from a Canadian base access

to the unique knowledge, expertise, and capabilities available at Canadian universities and colleges. Industry partners gain access to the unique knowledge and expertise of researchers in order to solve problems relevant to their organization. Researchers apply their knowledge to real-world problems while staying abreast with current technologies used within the private sector.

**Jeannette Janssen** successfully applied for an NSERC Engage grant with Scotiabank. The contact with the company was made by Evangelos Milios, Associate Dean Research in the Faculty of Computer Science. Students involved in the project are Huda Chuangpishit, from our department, and Neil Burke, from CS. The project involves solving a complex marketing problem, using mathematical algorithms. The aim is to choose one particular marketing approach (which customer to offer what product) from among a multitude of possibilities, in such a way that benefit is maximized. Moreover, this optimization problem will have to be solved many times with different constraints. The aim is to find an efficient implementation of the algorithm that allows the decision makers to try different scenarios in a reasonable amount of time.

The grant was awarded a few weeks ago, and is starting this week (May 24). Both the team from Scotiabank and Dr. Janssen and her team are looking forward to this new challenge

### **Research partnership with Palomino through NSERC Engage.**

**Hong Gu** was awarded an NSERC Engage grant to work with Palomino. Palomino is a web document management company with experience in the

management of health documents for the Guysborough Antigonish Strait Health Authority in Nova Scotia. Radiology reports are dictated by the doctor and speech is transcribed and stored as text.

Turning text reports into structured information will be a significant boost in the exploitation of electronic health information for population health. Two challenges need to be addressed to achieve a sufficiently accurate system that extracts structured data from unstructured text of radiology data. First, different types of errors in the text arising from the speech-to-text conversion need to be identified and corrected. Second, medical conditions and their values (e.g. normal vs. abnormal) must be extracted from the corrected text, by reference to a taxonomy of medical conditions. Once a corpus of radiology reports has been converted into structured data, in the form of condition-value pairs, classification will be used over a large radiology report corpus to provide insights in population health.

### **A New Branch**

On July 1, 2016, **David Hamilton** will begin a new branch of his life as he joins his wife, Laurie, in retirement. David joined Math & Stats in 1980 and has had a long a successful career with here. His many students and associates wish him well although it appears that he will continue to grace our hallways for a while yet as he continues his research and student supervision.

David's love of the outdoors and gardening is recognizable in the many plants he has propagated throughout the Department. Although some may move to a new home,

others will continue to provide us with joy, softening the hallways with their presence.  
-qcs

## MATH AND BIONIC KNEE BRACES

We like to tell prospective Math students that with a mathematics degree one can do pretty well anything. Another example for this was published very recently in a half-page article in the Business section of the Globe & Mail, no less.

Our honours mathematics graduate Bob Garrish went into engineering, and more recently bioengineering. He is co-founder of a start-up company, Spring Loaded Technology Ltd., which now has 17 full-time employees and is located in a Dartmouth industrial park. Their main product is their patented "bionic" power-boosting leg brace. The Globe & Mail article, "'Bionic' knee brace puts a spring in the step of inventors" was published on May 18, and can be found on page B7, along with a picture of Bob Garrish and his business partner. - kd

## POSTDOCTORAL FELLOWS

Postdoctoral fellows have always greatly contributed to the Department's life, have strengthened our research profile, and usually taught at least one course per academic year. And some have returned later to become tenured faculty members in our department. Here are the postdoctoral fellows of 2014/2015.

**Urban Larsson** has been with us for 2 years now as a Killam Postdoctoral Fellow, working with Richard Nowakowski. He will be staying with us for the summer but has

some new prospects for the fall. Good luck and happy travels in your new ventures Urban.

**Marie Augre-Methe** arrived in August 2014 to work with Joanna Mills-Flemming in the Ocean Tracking Network. Marie comes to us from completing her PhD in Biology at the University of Alberta in Edmonton. She did her BSc and MSc in Biology at Dalhousie so is very familiar with our campus.

**William Aeberhard** is also working with Joanna Mills-Flemming and has been with us for a year now. He is working on the Collaborative Research Team project "Advancement to State-Space Models for Fisheries Science" funded through the Canadian Statistical Sciences Institute / Fields Institute at the University of Toronto. William has become a very active member of our Department.

**Daniele Gregoris**, has been working with Alan Coley this past year and is also becoming active in the Department with social as well as academic activities..

**Joep Evers** will be arriving in August from Netherlands by route of British Columbia where he has been working with Theodore Kolokolnikov in conjunction with Dr. Razvan Fetecau at Simon Fraser University.

**Israel de Souza Rocha** joined Jeannette Janssen in the fall of 2015 from Brazil.

**Chris Duffy** also joined Jeannette Janssen as an AARMS Outreach PDF in 2015. Chris has been working with various organization through his outreach position promoting Math in the province and connecting with other groups also doing outreach.

**Safoura Jafar Zadeh** arrived in January 2016 to work with Keith Taylor for a few months.

## VISITORS

In addition to our postdoctoral fellows, research visitors also contribute to the department's overall research climate. Once again this year we've had several medium- to long-term visitors from several different countries.

**Robert van de Hoogen** has been with us this year during his sabbatical from St Francis Xavier. He has been working with Alan Coley and David McNutt and is part of the organizing committee for the AARMS Black Hole workshop prior to the Atlantic General Relativity Conference in June 2016.

**Huaichun Wang** has continued working as a research assistant with Ed Susko and Andrew Roger of the Department of Biochemistry and Molecular Biology on statistical modelling of protein sequence evolution following the completion of his Postdoctoral Fellowship funded by the Center for Comparative Genomics and Evolutionary Bioinformatics. He received his Ph.D. in Biology at the University of Ottawa in 2005, and his research interests include Molecular Evolution and Bioinformatics.

**Fahimah Al-Awadhi** is an Associate Professor at Kuwait University, and is the Head of the Statistics and Operations Research Department there. She received her Ph.D. at the University of Bath in England. She has visited our Department a few times this year and will be spending her sabbatical year with us for the 16/17 year.

**Karen Chandler** continues her stay with us as a visiting scholar. She received her honours B.Sc. with us, and later received her Ph.D. in algebraic geometry from Harvard University. She has also been a regular participant of the legendary Tuesday Lunch.

**Aaron MacNeil** is a Dalhousie graduate with a B.Sc. in Marine Biology (2001). He received his Ph.D. in that field from the University of Newcastle upon Tyne (UK) in 2007, and now holds positions with the Australian Institute of Marine Science and the Bedford Institute of Oceanography. Here in our department he works with Chris Field and Joanna Mills Flemming.

**Lerna Pehlivan** is with us for an extended visit. She is working with Jeannette Janssen.

## NEW SCHOLARSHIPS

The Department of Mathematic and Statistics has been honoured with the addition of several new scholarships for various levels of education.

### **Arnold and Beatrice Tingley Memorial Scholarship**

In honour of Dr. Arnold & Mrs. Bea Tingley and their commitment to Dalhousie University, this renewable memorial scholarship is to be awarded to a BSc or BA undergraduate student entering third year of a four year program.

### **Peter and Anne Ellen Fillmore Scholarship in Mathematics**

An emeritus professor in the department, Peter Fillmore, has endowed a scholarship which we hope to award for the first time this spring. Ideally the recipient will be a

graduating math honours or major student from the Maritimes who plans to become a high school math teacher. Demonstrated admission to a math education program is preferred.

### **The Rigetti Computing Prize Fellowship**

provides an annual scholarship of \$50,000 for a graduate student or post-doctoral fellow who is involved in developing a quantum computing programming language. Rigetti Computing, based in Berkley, California is building quantum computing technology to accelerate advances in quantum chemistry, material design, and machine learning. The student will also be given the opportunity to work with the cutting edge quantum computing hardware and software tools at the company.

### **MATH KANGAROO CONTEST**

Dr. Lois Murray, Halifax Regional Representative, Canadian Math Kangaroo

The 2016 Canadian Math Kangaroo Contest was hosted in classrooms at the Chase Building on March 20th, 2016 marking the fifth time the contest was offered in Halifax. In Canada, this year, there were 43 contest sites at which a total of 4485 students, enrolled in grades 1 through 12 competed. Here at Dalhousie University there were 66 competitors, representing all 12 grades. These students fared remarkably well: one Grade 8 student had a perfect score, thus placing first in Canada; one Grade 4 student placed third in Canada; three students won National Gold medals; four won National Bronze medals; and 17 other students scored high enough to receive Regional ribbons.

There will be a ceremony for these award-winning students and their supporters early

in June to celebrate their successes. I would like to thank **Elham Roshanbin** for her generous effort in helping set up the rooms and invigilate the students and **Dr. Dorette Pronk** for her help with invigilation.

### **THE MATH CHALLENGE CLUB**

Dorette Pronk

Fall 2015, **Jeannette Janssen** and **Dorette Pronk** started a new program, The Math Challenge Club, to reach out to junior high and high school students who want to engage in problem solving. This program receives funding from AARMS and meets weekly in the Chase Building. The group is especially welcoming to female students, but all students are welcome. The group started with five regular students, but has more than doubled during the second semester and includes now a couple of eager elementary school students.

They train for specific competitions such as the Math Kangaroo Contest, but they also work on general problem solving techniques and work through the mathematical theory needed to be able to participate in competitions such as the Canadian Open Math Competition. The training sessions are characterized by lots of interaction and enthusiastic discussions. This year, **Elham Roshanbin**, one of our graduate students with a lot of contest experience in her native country of Iran, has assisted in the training sessions. This has provided us with possibility to provide individual assistance to students who may not be familiar with some of the concepts we cover.

Some comments from parents and students who attend regularly:

“Ethan is thoroughly enjoying the math challenge club. It is a real highlight of his week.”

“I would like to thank you for organizing the sessions on Tuesday. They were a lot of fun and I learned a lot.”

### A 100th BIRTHDAY...

... with a Dalhousie connection. The prominent Canadian mathematician Richard Guy (University of Calgary) will celebrate his 100th birthday this Fall. Among the various honours he is about to receive, there will be a special session on Combinatorial Games in Richard's honour during the upcoming CMS Summer Meeting in Edmonton (June 24-27), organized by Richard Nowakowski who was Richard Guy's Ph.D. student.

Of the 6 speakers in the session, three are current department members (**Richard Nowakowski**, **Melissa Huggan**, and **Svenja Hunteman**), and two are Ph.D. graduates of this department (Rebecca Milley and Paul Ottaway).

Our department is represented also in other special sessions: **Theodore Kolokolnikov** will speak in the PDE session, Svenja Huntemann in the session on Mathematics Outreach Programs, and **Karl Dilcher** in the Analytic Number Theory session. Our recent Ph.D. graduate Danielle Cox will speak both in the Computational Number Theory session, and in the session on Mathematics Outreach Programs.

## UNDERGRADUATE MATH CONFERENCE

Brandon Elford

The 2015 Canadian Undergraduate Math Conference was hosted by the University of Alberta in Edmonton, Alberta. Dalhousie was well represented once again by sending eight students who presented four talks at the conference. The participants were Dario Brooks, Emma Carline, Mikaela DeBoer, Brandon Elford, Justine Gauthier, Mohammad Kidwai, Kyle MacQuin and Sohraub Pazuki. The students were largely funded by Dalhousie Math Department's annual fund and the generous donations to the department.

This year's Canadian Undergraduate Math Conference will be hosted in British Columbia at the University of Victoria. We are expecting a great turn out for this conference once again, which is possible thanks to the generous donations to the Math Department. For more details on the conference, visit [cumc.math.ca/2016/](http://cumc.math.ca/2016/).

## COMPUTING RESOURCES

by Balagopal Pillai

The department machine room operated without any major issues the past year. New webwork servers got deployed to host assignments for Math 1000 and several other courses. The existing capa deployment is getting used by more Statistics courses.

## BOOKS FOR SALE

Members of this department, and readers of past Chase Reports, know that for many years I have sold surplus mathematics and statistics books, with proceeds going to the purchase of new library books. More recently, with the availability of free shelf space in the former library space in the basement, I was able to collect all those countless (between 1500 and 2000) volumes in one place and catalogue them. Please see <http://www.mathstat.dal.ca/~dilcher/oldbooks.html>

This was advertised through the CMS a few months ago, and as a result I already sold about 500 volumes. This time all proceeds go, in equal parts, to the CMS and to this department. The sale is ongoing, and the list is up-to-date. Graduate and undergraduate students in this department will get 50% off the already reasonable prices.

Most of these books were donated over the years (and decades) by current and retired faculty members, while some others are library discards or review copies.

As always, I welcome further donations of mathematics, statistics and related books. Eventually most of them find a good home, and as an extra bonus, two good causes will be supported.

- Karl Dilcher

## AARMS REPORT

by Jeannette Janssen

The year 2015 brought further positive developments for AARMS. Several of our programs expanded, and new initiatives took off. Continued collaboration with the

other Math Institutes led to several significant joint activities, and we pursued new international collaborations. Visibility of AARMS continues to increase, and our voice is more clearly heard on the national stage.

The AARMS summer school was held at Dalhousie again, and led by **Theodore Kolokolnikov**. The theme in 2015 was Differential Equations and Numerical Analysis. Three workshops related to the school were held concurrently, making this a summer of extraordinary activity in this research area. This conformed to our goal of developing the summer school into a short thematic program, where the presence of expert lecturers and eager students is used to create a focused program of research activity.

This year, the province of Nova Scotia increased its funding for AARMS to 100K annually, with the expectation that this level of funding will continue in future years. This funding has allowed us to create the position of AARMS Outreach coordinator. This position is filled by a post-doctoral fellow, and thus contributes to the research objectives of AARMS as well. The position was advertised across all mathematical disciplines, and was filled by Christopher Duffy, who, coincidentally, chose to work with me! Also, a number of new Outreach activities took off this year. There are new or expanded school visit programs in Nova Scotia, PEI and New Brunswick, and a new math challenge club with a special focus on female students.

Two new Collaborative Research Groups started this year, in Iterated Function Systems, and in the Mathematical and Physical Aspects of Black Holes. The highly successful CRG in Numerical Analysis and Scientific Computing was renewed for a second term. It is worth

mentioned that this CRG is pursuing collaborations with industry. The group held a workshop where industrial representatives were invited to present real-life problems, and is now investigating the possibility of taking advantage of NSERC's collaborative opportunities.

In addition to the workshops already mentioned, AARMS supported a variety of events this year. By sponsoring a large number of sessions, AARMS was an active partner in the 2015 CMS meeting, which was held in PEI. In addition, AARMS sponsored a number of focused research meetings, and also contributed to other events with high significance for our region. Also, we sharpened the focus of our event funding by adopting a new policy which clearly distinguishes AARMS workshops, which are targeted meetings of high quality, with 40-60 participants, from other events. AARMS workshops are favoured, since such events are felt to have the highest impact.

Finally, in 2015, five new post-doctoral fellows were chosen in the competition; in addition the Outreach coordinator and Director's PDF led to an increase of our PDF program.

In June, I will hand over the directorship. I have enjoyed leading AARMS over the last five years. It was a great opportunity to get to know the mathematical community in our region, and the rest of Canada, and learn about the excellent work that is being done here. I would like to end by thanking the AARMS Executive and to the Board, and a special thanks to David Langstroth. It has always been a pleasure working with David, and his efficiency made the job an easy one. Thanks also to the members of our community for their enthusiasm and energy, which is what makes our programs great.

## **AARMS/PIMS SUMMER SCHOOL 2015** by Theo Kolokolnikov and Hermann Brunner

In July 2015 we hosted AARMS/PIMS summer school in differential equations and numerical methods. In total, 45 students participated in a month-long school. There was a total of four courses taught by seven instructors. These courses were:

1. Waves and patterns in nonlinear systems. Instructors: Ricardo Carrettero and Theodore Kolokolnikov.
2. Topics in Reaction-Diffusion Systems: Theory and Applications. Instructors: Michael Ward and Juncheng Wei
3. Structure-preserving discretization of differential equations. Instructors: Elena Celledoni and Brynjulf Owren
4. Numerical analysis of singularly perturbed ODEs and PDES. Instructor: Martin Stynes.

Concurrently with the summer school, there were three associated workshops in differential equations that the school participants were also invited to attend:

- Bluenose Workshop (July 11-12).
- Workshop on Pattern Formation in Differential Equations (July 18-19).
- Workshop on Domain Decomposition methods for PDEs (Aug 4-8).

The participants also enjoyed many social activities. One of the highlights was lobster boil in Point Pleasant Park (see photo).



We are grateful to AARMS and PIMS for providing the funding for the school and associated workshops.

### **AARMS SUMMER SCHOOL 2016**

This is the third consecutive year that the AARMS Summer School will be held at Dalhousie University.

The topics and instructors of this year's courses are:

Higher Category Theory and Categorical Logic taught by Dr. Michael Shulman, University of San Diego, and Dr. Peter Lumsdaine, Stockholm University  
 Categories, Quantum Computation and Topology taught by Dr. Jamie Vicary, University of Oxford

Stable polynomials: with applications to graphs, matrices, and probability taught by Dr. David Wagner, University of Waterloo  
 An Introduction to Special Functions and WZ Theory taught by Dr. Armin Straub, University of South Alabama

Just over a quarter of the students this year are from Atlantic Canada. The other students are coming from America, the Netherlands, Ghana, Australia, Ethiopia, Denmark, Croatia, Italy, and France. We will also have four postdocs auditing the courses. In addition, this is the first year

that AARMS is sponsoring students enrolled in the AIMS programs in Africa to join our summer school.

The summer school will be followed by the international conference in category theory, Category Theory 2016, giving our students the opportunity to stay and learn more about current research. We are looking forward to an active and engaging summer.

We are grateful for all the administrative assistance provided by Queena, our departmental administrator, and David Langstroth, the AARMS administrator.

**Dorette Pronk** (Dalhousie University) and **Geoff Cruttwell** (Mount Allison University), AARMS Summer School Directors.

### **2015 ANNUAL MEETING OF THE STATISTICAL SOCIETY OF CANADA**

Dalhousie hosted the 2015 Annual Meeting of the Statistical Society of Canada (SSC) in June 2015. This is the largest gathering of statisticians in the country with 485 attendees. The meeting started with a series of day-long workshop on statistical topics given by experts from across the country. Scientific sessions took place from Monday – Wednesday and covered a broad range of topics including theoretical development of statistical methods as well as applications of statistical methods to areas spanning the sciences and social sciences.

**Ed Susko** was the chair and local organizer for the SSC Annual Meeting. The SSC student conference was also held on Saturday June 13 prior to the SSC Annual Meeting.

## SSC Student Conference

By Lihui Liu

The 3rd SSC (Statistical Society of Canada) student conference, was held as a part of the 43rd Annual SSC meeting last year. I co-organized this event with other organizers from major Canadian universities. The experience was valuable and memorable. Many graduate students from our department (Michael Bulter, Yun Cai, Chang Chen, Hao He, Chaoyue Liu, Lihui Liu, Holly Steeves, Chongci Tang, Mary Roop, Maria Rosario Reyes, Bryan Maguire, Kim Whoriskey, Yihao Yin, Jing Zhang) were involved in volunteering for both SSC student conference and the main conference. Their efforts and dedication have been well recognized by the society and guests.

I would also like to take this opportunity to thank for a kind donation of over 30 items with Dalhousie logos from DSU bookstore and those gifts were given to invited guests and students as awards and prizes. In addition, the Math & Stats Graduate Students' Association kindly sponsored the room booking and equipment rentals and it significantly reduced the cost of the student conference.

## WORKSHOPS

### Pre-Atlantic GR Conference Workshop and Lectures: June 23-24

In June, Dalhousie university will host the annual Atlantic General Relativity conference (June 23-24). This annual conference is preceded by a workshop at Dalhousie and organized by the Atlantic Association for Research in the Mathematical Sciences (AARMS) collaborative research group on the

mathematical and physical aspects of black holes (June 20-22). This workshop will consist of invited lectures from leading experts on various aspects of classical and quantum gravity.

In preparation for these two events, **Alan Coley** (Dalhousie), Robert van den Hoogen (St. of X), and in cooperation with researchers at UNB and MUN have organized a set of introductory lectures (June 18-19). The goal of these lectures will be to prepare senior undergraduate and graduate students for the topics discussed during the workshop and conference. The introductory lectures will be given by four post-doctoral researchers: Andrey Shoom (MUN), **Daniele Gregoris** (Dalhousie), **David McNutt** (Dalhousie) and Jon Ziprick (UNB); and they will review elementary aspects of differential geometry, general relativity, black holes, and quantum gravity

### Games@Dal 2015, Aug. 11-14

Organizers S. Huntemann, U. Larsson and R. J. Nowakowski.

Nineteen people, including 4 students, attended the Workshop who came from Belgium, Canada, France, Israel, Portugal, Scotland, Sweden, and USA. The first day of the Workshop consisted of talks:

1) Alda Carvalho, C. Santos, (Portugal): *Oak, ordinal sums and the generalized mex function;*

2) A. Fraenkel, Lior Goldberg (Israel): *Extensions of the results of Duchene, Fraenkel, Nowakowski and Rigo, "Extensions and restrictions of "Wythoff's game preserving its P-positions" to Generalized Wythoff ( $|k - \ell| < t, t > a$  fixed integer).*

3) Neil McKay\* (Canada): *Sums of Hackenbush Stalks*

4) Gabriel Renault (Belgium): *Invertibility modulo dead-ending no-P-universes*

5) Simon Rubinstein-Salzedo (USA): *Multi-pile Fibonacci nim*.

6) Craig Tennenhouse (USA): *New Bogus Nim variants*

This was followed by three days of intensive work.

In particular, six problems caught the attention of subgroups. People wandered between subgroups and joined in the conversations.

1: Subversion: is a game with self-referential rules that also is an instance of a game where, at each stage, at most one player has a non-terminal option. The canonical forms can be complicated but it was discovered that the Atomic Weights are restricted to being integral,  $-1/2$ ,  $1/2$ , and a switch of the form  $\{-2 \mid x\}$  or  $\{x \mid 2\}$ . The conjecture is that if the game has finite nim-dimension then the Atomic Weights will also be restricted. A paper is now in preparation, authors: Fisher, Mckay\*, Nowakowski, Ottaway, Santos.

2: Complexity of Placement Games: A placement game has players placing pieces which then cannot be moved or removed from the board. Although not solved in general, the case for "Distance Games", for example COL and SNORT, was solved. A paper is now in preparation, authors Burke, Heuback, Huggan\* and Huntemann\*.

3: Global Fibonacci Nim: This is a game introduced by Whinihan (1963) but was only solved for 1 heap. Using Zeckendorf representations and fibonacci words, the two heap case was solved and made inroads on the multi-heap case. A paper

has been submitted, see arXiv:1509.08527, authors Larsson and Rubinstein-Salzedo.

4: MEM games: originally proposed by Conway (see Winning Ways 1982 edition). Very little progress has been made until this Workshop. A paper is now in preparation, authors Larsson, McKay\*, Rubinstein-Salzedo and both Siegels

5: Many variants of Leapfrog: these arose out of a question raised by Richard K. Guy. Intriguing conjectures were obtained but no definitive progress as of yet.

6: Blocking Games: add to any ruleset the option for the previous player to forbid a particular option on the next turn. This led to an ongoing discussion of cellular automata generated by combinatorial games.

\* indicates student..

## CONFERENCE ON ABSTRACT HARMONIC ANALYSIS

Keith Taylor

The techniques of analysis build up to exploit the presence of a symmetry group of the underlying space in order to better understand functions on that space are collectively referred to as abstract harmonic analysis. This area of mathematics underlies many other areas ranging from probability theory to signal processing and from quantum mechanics to number theory. From August 17 to 21, 2015, an international workshop and conference on abstract harmonic analysis with the title AHA 2015 was held in Halifax.

There were 42 participants in the conference, distributed as follows: Canada

(17), USA (2), UK (4), Germany (4), Spain (2), Sweden (2), France (1), Switzerland (1), Austria (2), Finland (1), Tunisia (1), Hong Kong (1), New Zealand (1), South Korea (1), South Africa (1), Poland (1). Of the 17 Canadian participants, 10 were students or post-docs. Thus it was very much an international conference. The scientific committee of the conference consisted of Eberhard Kaniuth (Paderborn), Zhong-Jin Ruan (Illinois), Anthony Lau (Alberta) and **Keith Taylor** (Dalhousie).

Focused conferences such as AHA 2015 provide an ideal environment for the sharing of recent research advances and, perhaps more importantly, the stimulation of new research projects and collaborations. They are particularly important for graduate students and recent PhDs as they are building their networks of contacts and disseminating their own discoveries. We are grateful to the Atlantic Association for Research in the Mathematical Sciences (AARMS) for the primary funding of the conference. The Fields Institute for Research in the Mathematical sciences (Fields) and the Department of Mathematics & Statistics at Dalhousie also provided valued support to insure significant participation by graduate students and early career researchers.

## **NOVA SCOTIA MATH CIRCLES**

by Svenja Huntemann

Another excellent year for Math Circles! Thanks to the second year of funding by Eastlink we have been able to go on even more trips and create several new presentations, which are currently undergoing trials.

As in previous years, we had a great team. **Richard Nowakowski** continued as faculty advisor, **Svenja Huntemann** as director, and **Ben Cameron** was assistant director. Marie B.Langlois, Melissa Huggan, and Lucas Mol were teaching assistants with the support of the department. Our casual presenters were Evangelia Aleiferi, Bassemah Alhulaimi, Abdullah Al-Shaghay, Todd Best, Dario Brooks, Huda Chuangpishit, Corey DeGagné, Brandon Elford, Kyle MacQuin, Sohraub Pazuki, Francisco Rios, Elham Roshanbin, Asmita Sodhi, Hayley Tomkins, and Julia Tufts.

In the fall we had two weeklong trips, one to the Tri-County Regional School Board, and one to the Strait Regional School Board, as well as many day trips. In the winter we went on more local trips as weather and scheduling made things quieter. Our schedule has started to pick up again this spring with more trips to other schoolboards.

As of early May, we have reached over 3600 students during approximately 165 presentations. We still have several more trips planned for the rest of May and during June and July.

Math Discovery Days were held at the department on April 25th, 26th, and May 2nd. After adding two additional sessions last year, we added another two this year. During the six sessions, over 200 students learned about Mathemagic and enjoyed a snack break.

Our monthly events in the Learning Centre were also well attended. We had a mix of presentations, some done by our graduate student team members, some by faculty members (**Karl Dilcher** and **Richard Nowakowski**), or outside presenters (David Wolfe, John McLoughlin, Erick Lee). During our upcoming June event, we will be celebrating two successful years

working with Eastlink. Danielle Cox, our former director, will be presenting. Hope to see you there!

### **DAL- BEA MATH CAMP 2015 REPORT** by R.P. Gupta

The Dal-BEA Math camp for black students was held July 5-11, 2015. Twenty Eight campers attended the camp. Sixteen were female and twelve male campers. They came from Junior High schools from all over Nova Scotia.

On Sunday, July 5, 2015, parents brought the campers to Howe Hall, where registration and reception was held. Campers and their parents were introduced to the organizers, chaperons and instructors. Campers and their parents were explained the expectations and the responsibilities. The campers stayed in the Howe Hall under the supervision of four chaperon - Nakies Davies, Dominic Hudin, Josh Ludin and Celeste Williams.

Mornings and three afternoons were devoted to academic teaching. The instructors were Mr. Gerry Clarke, Mr. Preman Edward, Dr. Nauzer Kalyaniwalla and Ms. Melina Kennedy.

On Monday afternoon the campers visited the museum and in the evening career night presentations were given. They discussed the importance of education and in particular how mathematics plays an important part in daily life as well as in various career opportunities. The campers were very focused and asked many questions. On Tuesday, they went for bowling at Bayers Road. A special arrangement was made to see Nova Scotia Tattoo on Wednesday evening campers had a great time. On Thursday evening

they had a talent night in Howe Hall and on Friday they went to discovery center. They went to Dalplex every afternoon from 3:15 to 4:30 p.m.,

The 25th anniversary of the math camp was celebrated with many events throughout the week. For these celebrations camp was extended for one day. On Saturday evening a gala dinner was organized in the University Hall of the faculty club. About 130 people attended this function. The masters of ceremonies were Allister Barton and Nikki Davies. Besides many cultural events, the highlight was to honour Professor Chelluri Sastri, and Mr. Gerry Clarke as founder of the camp and their dedication as teachers. Professor R.P. Gupta was also honoured for his services as organizer of the camp for almost twenty years. They were presented plaque and flowers. Dr. Nauzer Kalyaniwalla announced that he is donating his stipend for a scholarship to a camper.

We would like to thank our supporters in particular Dalhousie University President, AARMS, Canadian Math Society and Black Educator's Association for their financial support.

### **DALHOUSIE-CMS MATH CAMP** **July 5-10, 2015** by Roman Smirnov

As always during the second week of July, last year the Department of Mathematics and Statistics at Dalhousie University hosted the Dal-CMS math camp, whose goals were to identify, stimulate and encourage mathematical talent among Nova Scotia high school students.

The camp was jointly sponsored by Dalhousie University and the Canadian Mathematical Society. It consisted of lectures and problem solving sessions conducted by Faculty members and graduate students from Dalhousie and Acadia Universities and also included extracurricular activities. The math camp was organized by **Caroline Cochran**, **Marie-Andree B Langlois**, and **Roman Smirnov**.

The following Faculty members and grad students volunteered to speak at the camp (with the titles of their respective talks in the parentheses):

David Iron (Mathematical Modeling and Dynamical Systems),  
 Marie-Andree B Langlois (Secret Well Kept), Lucas Mol (Party in Koenigsberg - BYOG (Bring Your Own Graphs),  
 Keith Taylor (All Star Real Numbers),  
 Roman Smirnov (Mathematical Induction),  
 Chelluri Sastri (Pythagorean Triples),  
 Caroline Cochran (What is Proof in Mathematics?),  
 Phil Munz (What are the Chances?),  
 Richard Nowakowski (John Nash and Games).

The students were chaperoned by Dario Brooks and Emma Carline.

Last but not least, our great staff, Queena Crooker-Smith, Maria Fe Elder, Balagopal Pillai, and Ellen Lynch did a fantastic job, while helping us to organize the camp.

This year's math camp is being organized by **Marie-Andree B Langlois** and **Roman Smirnov**. Think about contributing to the camp as a volunteer speaker.

## DMSGSA REPORT

by Darien DeWolf

The Annual General Meeting of the Dalhousie Math & Stats Graduate Student A culminated in the election of the executive members:

President: Darien DeWolf

Vice-President: Bassemah Alhulaimi

Secretary/Treasurer: Benjamin Cameron

Lett Bursary Representative: Melissa Huggan

Department Liaison: Corey DeGagné

DAGS Representatives: Corey DeGagné,

William Aeberhard and Abdullah Al-

Shaghay

Overall, it has been a very successful year full of fun events: the classic "Coffee, timbits, etc." monthly coffee breaks were a hit again this year; the Islamic Feast of Sacrifice was made in style this year at our Eid al Adha celebration, planned by Bassemah and Amal; Chairman Hao led the charge in celebrating Chinese New Year on this Year of the Monkey; Pi Day, brought to you by Pete's, was delicious of course; the re-introduction of our Graduate Seminar saw several interesting talks by our own graduate students and were followed by great Games Nights; and last but not least, the graduate students enjoyed a fantastic(ally subsidized) meal at our December (at the Foggy Goggle) and April (at the Wooden Monkey) restaurant get-togethers.

Administratively, this year saw the launch of DMSGSA.com, an online sales platform to streamline the sale of tickets to our end-of-year tutorials. This system was a huge success and allowed us to have more high-quality events this Fall and Winter with enough surplus to have Summer Events. Chaired by Corey, a committee was formed to rewrite our society constitution and write a set of society bylaws. These

bylaws and our new constitution reflect the past operations and were passed at our April General Meeting.

Darien DeWolf  
President  
DMSGSA

## **THE UNDERGRADUATE MATHEMATICS AND STATISTICS SOCIETY (DUMASS)**

by Brandon Elford

2015/16 Council members:

President: Brandon Elford  
Vice President: Kyle MacQuin  
Treasurer: Todd Best  
Secretary: Sohraub Pazuki  
Communications Officer: Luke DeCoffe  
DSS Reps: Lindsay MacCormick and  
Timma Flanagan

The Undergraduate Math and Stats Society has had another successful year thanks to increased student involvement and many engaging events. Each year we strive to provide an environment for our students to socialize and collaborate. Thanks to a great effort from our executives, who helped by putting up posters and visiting classes, we have certainly achieved our goal.

We began the year with our annual DUMASS Meet and Greet. This event is always a huge hit as it is the best opportunity to become acquainted with students and staff in the department, in a situation separated from the classroom.

Throughout the academic year we often collaborated with other societies for our events, including both the undergrad economics and physics societies and the Graduate Math and Stats Society. These events also cause many students to come

out thanks to a large amount of academic overlap.

The final event of the school year was our annual Wine and Cheese. With the addition of a live music ensemble and great advertising the turnout was fantastic! This event is always a favourite of the society as it gives us a chance to close out the academic year in style.

We would like to extend our thank you to all those who attended DUMASS events this year. We would not be here if it was not for the students and you have all made the 2015/16 year a great one!

The DUMASS executives would like to extend our congratulations and good wishes to the new Mathematics and Statistics graduates!

Lastly, we would also like to welcome and congratulate the new executives of DUMASS! Good luck to you all in 2016/17:  
President: Sohraub Pazuki  
Vice President: Todd Best  
Treasurer: Lindsay MacCormick  
Secretary: Morgan Garnier  
Communications: Timma Flanagan  
DSS Reps: Mohammed Assem and Josh Feldman

## **MATHEMATICS COLLOQUIUM**

Organizer: Dorette Pronk

As in every year, the Mathematics Colloquium featured an interesting mix of talks from many areas of mathematics. I would like to thank all members of the Chase community who suggested speakers. This year's talks were:

April 7, 2016 Oleksiy Klurman, (University of Montreal), *"Pretentiousness" in analytic number theory*

April 5, 2016 David Pike, (Memorial University of Newfoundland), *Block Designs and Gray Codes*

Thursday, March 3, 2016 (Paul Halmos' 100th Birthday) *Movie: I Want to Be a Mathematician: A conversation with Paul Halmos*

November 16, 2015 Rebecca Stones, (Nankai University, China), *Partial Latin Rectangles with Specified Symmetry Groups*

September 28, 2015 Lance Littlejohn, (Baylor University), *Glazman-Krein-Naimark Theory, Left-Definite Theory and the Square of the Legendre Polynomials Differential Operator*

July 30, 2015 Soumen Sarkar, (University of Regina). *Some Aspects of Topological Complexity and the Equivariant LS-Category*

July 23, 2015 Heydar Radjavi, (University of Waterloo), *Can Values of a Single Functional on a Group of Operators Give Away its Structure?*

June 25, 2015 Jordan Watts, (University of Illinois at Urbana-Champaign), *The Differential Structure of an Orbifold*

Upcoming Colloquium:

Thursday June 23 Jon Borwein (University of Newcastle) *Seeing things by walking on numbers*

## STATISTICS COLLOQUIUM

Organizer: David Hamilton

This year the Statistics Colloquium featured a nice collection of talks from many areas of statistics. Suggestions of speakers for the 2016/2017 Academic Term are most encouraged. Details of this year's talks are provided below.

September 24, 2015: Duncan Murdoch (University of Western Ontario), *Recent Developments in rgl.*

October 1, 2015: Mohsen Kompany-Zareh (Institute for Advanced Studies in Basic Sciences (IASBS), Iran), *Application of Type I and Type II Errors for the Selection of Variables in Multivariate Regression.*

November 2, 2015: Michael Rosenblum (Johns Hopkins Bloomberg School of Public Health), *Methods for Estimating Causal Effects in Observational Studies.*

March 10, 2016: Peter D. Wentzell, Department of Chemistry, Dalhousie University), *Projection Pursuit for the Exploratory Analysis of Multivariate Chemical Data.*

March 24, 2016: Swarna Weerasinghe, (Department of Community Health and Epidemiology, Dalhousie University), *Small area population level air quality health risk assessment using zero inflated multipollutant exposure models: Application to asthma hospital admissions.*

March 31, 2016: William Aeberhard (CANSSI – department of Mathematics and Statistics, Dalhousie University), *An Attempt at Robust and Consistent Estimation of Fixed Parameters in General State-Space Models*

April 21, 2016: JC Loredano-Osti, (Memorial University), *Time series and state state models for extreme value variables*

**@CAT SEMINAR 2015/2016**

Organizer: Bob Paré

July 21, 2015: Jeff Egger, *Effort locales and (quasi)uniform locales, part 0*

July 28, 2015: Jeff Egger, *Effort locales and (quasi)uniform locales, part 0.5*

August 4, 2015: Jeff Egger, *Effort locales and (quasi)uniform locales, part 1.0*

August 11, 2015: Jeff Egger, *Effort locales and (quasi)uniform locales, part 1.5*

August 18, 2015: Jeff Egger, *Effort locales and (quasi)uniform locales, part 2.0*

August 25, 2015: Jeff Egger, *Effort locales and (quasi)uniform locales, part 2.5*

September 1, 2015: Jeff Egger, *Effort locales and (quasi)uniform locales, part 3.0*

September 29, 2015: Gabor Lukacs, *Weakly complete spaces and the character groups of Hopf algebras (joint work with Rafael Dahmen)*

October 6, 2015: Gabor Lukacs, *Weakly complete spaces and the character groups of Hopf algebras (continued) (joint work with Rafael Dahmen)*

October 13, 2015: Peter Selinger, *Interacting Hopf Algebras*

October 20, 2015: Bob Paré, *Superspans*

October 27, 2015: Peter Selinger, *Interacting Hopf Algebras (continued)*

November 10, 2015: Richard Wood, *The Characterization of Totally Distributive Categories*

November 17, 2015: Bob Paré, *Intercategories of Superspans*

January 5, 2016: Richard Wood, *Introduction to cartesian bicategories*

January 12, 2016: Dorette Pronk, *Segal Factorization and General Composition in a Double Category*

January 19, 2016: Dorette Pronk, *Segal Factorization and General Composition in a Double Category - continued*

January 26, 2016: Rory Lucyshyn-Wright, *Enriched algebraic theories and monads for a system of arities*

February 2, 2016: Rory Lucyshyn-Wright, *Enriched algebraic theories and monads for a system of arities - continued*

February 23, 2016: Bob Rosebrugh, *Spans of edit lenses*

March 1, 2016: Jeff Egger, *Non-Hausdorff topologies and polar decomposition: a divertissement*

March 8, 2016: Jeff Egger, *An update on effort locales and quasi-uniform locales*

March 15, 2016: Jeff Egger, *An update on effort locales and quasi-uniform locales, part 2*

March 22, 2016: Geoff Cruttwell (Mount Allison), *Differential forms for tangent categories (Part I)*

March 29, 2016: Geoff Cruttwell (Mount Allison), *Differential forms for tangent categories (Part II)*

April 5, 2016: Bob Paré, *Change of base for double categories*

### COMBINATORIAL GAMES GROUP.

Members: Melissa Huggan (PhD), Svenja Huntemann (PhD), Urban Larsson (Killam PDF), N. McKay (PhD), R. J. Nowakowski.

The group ran the 10th in the Games@Dal Workshops in August 2015, with 19 participants, approximately half from outside Canada. The group also ran a semi-regular seminar on Friday afternoons. Visitors: Mike Fisher and Carlos Santos, Aug 2015; Silvia Heubach February 2016.

#### Published and Accepted papers:

*N. Clarke, S. Finbow, S. Fitzpatrick, M. E. Messinger, R. Milley, R. J. Nowakowski*, Grundy Number and Graph Products, Discrete Applied Mathematics (2016)

M. Cook, **U. Larsson**, T. Neary, A cellular automaton for blocking queen games, Cellular Automata and Discrete Complex Systems, 21st IFIP, LNCS 9099, 71--84 (2015).

E. Duchene, **U. Larsson**, S. Heubach, M. Dufour, Building nim, Int. J. Game Theory, (2015)

N. Fox, **U. Larsson**, An aperiodic subtraction game of nim-dimension two, J. Integer Seq., (2015).

**M. Huggan**, G. L. Mullen, B. Stevens, D. Thomson. Sudoku-like arrays, codes and orthogonality. Designs, Codes and Cryptography.

**M.Huggan, R.J.Nowakowski**. Conjoined Games: Go-Cut and Sno-Go. Games of No

Chance 5.

**U. Larsson**, Restrictions of m-Wythoff Nim and p-complementary Beatty sequences, Games of No Chance 4, Cambridge University Press (2015).

**U. Larsson**, S. Rubinstein-Salzedo, Grundy values of Fibonacci nim, Internat. J. Game Theory, (2015) :473 5(3)

#### Submitted

K.Burke, S.Heubach, **M.Huggan, S.Huntemann**, Keeping your distance is hard.

J. Chappelon, **U. Larsson**, A. Maatsura, 2-player Tower of Hanoi.

**M. Huggan**, B.Stevens. Polynomial time graph families for Arc-Kayles.

**U. Larsson**, J. Neto, **R. J. Nowakowski**, C. Santos, When waiting moves you in scoring combinatorial games, with Guaranteed scoring games.

**U. Larsson, N. McKay, R. J. Nowakowski**, A. Siegel, Finding golden nuggets by reduction.

**U. Larsson**, Simon Rubinstein-Salzedo, Global Fibonacci nim.

**bold** = present member; *italics* = past member

#### External Invited Talks

2015 CMS Summer Meeting, Public Lecture, **R. J. Nowakowski**

MOVES 2015 conference, The National Museum of Mathematics, **U. Larsson, R. J. Nowakowski**

Workshop on Combinatorial Games, MSRI,

2016, **R. J. Nowakowski**

### **MATHEMATICS HONOURS SEMINAR**

This seminar serves the dual role of featuring talks by faculty geared towards an undergraduate audience, and giving honours students the opportunity to give talks on their honours projects.

Organizer: Keith Johnson

#### **Faculty and Graduate Student talks:**

September 23, 2015 Dr. David Iron: *"The Turing Bifurcation."*

September 30, 2015: Dr. Jeannette Janssen: *Games of trust on a network.*

October 7, 2015: Dr. Rob Milson: *Classical Orthogonal Polynomials.*

October 14, 2015: Tony Vargas: *Abel's theorem and smoothing out power series*

October 28, 2015: Svenja Huntemann: *Combinatorial Games and Commutative Algebra*

November 4, 2015: Dr. Keith Taylor: *Hydrocarbon Chemistry, Structured Graphs, and Block Toeplitz Matrices*

November 25, 2015 Dr. Sara Faridi: *Chordal graphs, linear resolutions, and more*

#### **Student talks:**

November 18, 2016: Paul-Christopher Chavy-Waddy: *Invariant characterization of 5-dimensional pseudo-Riemannian manifolds*

December 2, 2015: Zipeng Lin: *Mesh selection using collocation methods applied to boundary value problems.*

January 6, 2016: Brandon Elford: *Combinatorial Scoring Games: An Analysis of 1D Diskonnect*

January 13, 2016: Emma Carline: *The structure of finite-dimensional  $C^*$ -algebras*

January 27, 2016: Anne Johnson: *Computing the Alexander Polynomial*

February 3, 2016: Will Hamilton: *The fundamental theorem of algebra for the Quaternions*

February 10, 2016: Cameron Phipps-Burton: *An Introduction to Directed Algebraic Topology*

February 24, 2016: David Isenor: *Lattices and Posets in Combinatorial Game Theory*

March 9, 2016: Haley Tomkins: *Some aspects of multiple zeta functions*

March 16, 2016: Calum McRury: *The Spectral Theorem*

March 23, 2016: Dimitri Duncombe: *Hedging Effectiveness of the Swiss Re Kortis Bond*

March 30, 2016: Sohraub Pazuki: *An Exposition on Socialist Primes and a Composite Analogue*

April 6, 2016: Nicholas Banks: *Fixed Points and Orbit Categories*

## OUTSIDE TALKS

Graduate students, postdocs, and faculty members presented a large number of talks nationally and internationally, at conferences and at department seminars and colloquia. Below is a list which is probably not complete.

### Marie Auger-Méthé

Publication in peer-reviewed journal:  
In Press Auger-Méthé, M, C Field, CM Albertsen, AE Derocher, MA Lewis, ID Jonsen, J Mills Flemming. *State-space models' dirty little secrets: even simple linear Gaussian models can have estimation problems. Scientific Reports*

Invited talk at conferences:

2015 Auger-Methe, M, I Jonsen, CM Albertsen, G Crossin, K Studholme, A Derocher, J Mills Flemming. Statistical Society of Canada Annual Meeting - *Using TMB to Quickly and Robustly Solve Problems from Marine Ecology, Halifax, Canada. Tackling the challenges of fitting movement models to marine data*

Invited seminar presentation:

2016 Department of Biology, Acadia University, Wolfville, *Canada From footsteps to foraging: using movement models to understand animal behaviour*

2016 Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, US *From footsteps to foraging: using movement models to understand animal behavior.*

Contributed talk at conferences:

2015 Auger-Methe, M, I Jonsen, CM Albertsen, G Crossin, K Studholme, A Derocher, J Mills Flemming. International Conference on Fish Telemetry, Halifax, Canada, *Tackling the challenges of fitting movement models to marine data*

### William Aeberhard

University of British Columbia Statistics Seminar, Vancouver, Canada. *An Attempt at Robust and Consistent Estimation of Fixed Parameters in General State-Space Models.*

Banff International Research Station (BIRS) Workshop on Current and Future Challenges in Robust Statistics, Banff, Canada. *A Proposal for Robust Estimation of Fixed Parameters in General State-Space Models.*

Annual Meeting of the Statistical Society of Canada (SSC), Halifax, Canada. *Nonparametric Estimation of Mixing Distributions for Mixed Poisson Models.*

### Karl Dilcher

Continued fractions and Stern polynomials, Czech & Slovak Number Theory Conference, Liptovsky Jan, Slovakia, Sept. 3, 2015.

Applications of generalized Stern polynomials, (1-hour talk) 'Number Theory Down Under', Newcastle, Australia, Sept. 19, 2015.

Generalized Fermat numbers and congruences for Gauss factorials, AustMS Meeting, Adelaide, Australia, Sept. 30, 2015.

Zeros and irreducibility of polynomials with gcd powers as coefficients, Colloquium Talk, Univ. of Newcastle, Australia, Oct. 15, 2015.

Stern polynomials, Fibonacci numbers, and continued fractions, Colloquium Talk, Austral. National University, Canberra, Oct. 29, 2015.

Generalized Fermat numbers and congruences for Gauss factorials, CMS

Winter Meeting, Montreal, December 7, 2015.

Gauss Factorials, Jacobi Primes, and Generalized Fermat Numbers, Seminar Talk, Carleton University, Ottawa, May 9, 2016.

Derivatives and fast evaluation of the Witten zeta function, 'Computational Discovery in Mathematics', Western University, May 12, 2016.

### **Svenja Huntemann**

CMS Summer Meeting in Charlottetown titled "Doppelgänger Placement Games".

### **Urban Larsson:**

Invited Talks, Seminars and Conferences

Mälardalens Högskola (MDH), MAM-seminar inv Prof K. Eriksson 16 Dec 2015

Participant, MSRI, workshop on combinatorial games, in honor of Elwyn Berlekamp's 75th birthday (co-author of three (!) presentations) 1-2 Nov 2015

Two presentations at Dalhousie University, Game Theory Seminar, inv Prof R. Nowakowski Sept, Oct 2015

West Chester University, Mathematics Colloquium, inv Dr. M. Fisher Oct 2015

MOVES 2015 conference, NYC, The National Museum of Mathematics 2-4 Aug 2015

University of Turku, Automata 2016, inv Prof J. Kaari June 2015

Chalmers University of Technology, seminar, inv Prof P. Hegarty 4 June 2015

Dalhousie University, seminar Dept. Mathematics and Statistics 1 April 2015

University of the Virgin Islands, inv Dr. D. Ianucci (also research) March 2015

G4G Europe, University of Lisbon (CELC), Portugal, inv. Dr. C. Santos, Prof. J. N. Silva 24-26 Jan 2015

CGTC 1, University of Lisbon (CELC), Portugal, inv Dr C. Santos 21-23 Jan 2015

University of Zurich, INI seminar, inv Prof M. Cook 17 Jan 2015

Published Papers (See the CGT Group)  
Urban had 5 published papers and submitted 4 additional papers.

**CHASE REPORT**

Is published for alumni and friends of the Department of Mathematics & Statistics, Dalhousie University.

**Editor:** Queena Crooker-Smith,  
Administrator

admin@mathstat.dal.ca  
Phone: (902) 494-6911  
Fax: (902) 494-5130

**Department of Mathematics and Statistics**

Bruce Smith, Chair  
Hong Gu, Statistics Director  
Roman Smirnov, Mathematics Director  
David IRoni, Mathematics Graduate Coordinator  
Joanna Mills Flemming, Statistics Graduate Coordinator

We welcome your suggestions and comments for future issues.