Atlantic Association for Research in the Mathematical Sciences

Annual Report 2012

www.aarms.math.ca

Table of Contents

Message from the Director

AARMS continues to stimulate and encourage research and education in the mathematical sciences. Our programs are successful in enabling new discoveries in the mathematical sciences, and their reach stretches far beyond the Atlantic region. The impact and quality of our program is not universally known to the Canadian mathematical community. It has been my goal, since becoming director, to increase the visibility and recognition of AARMS across Canada and internationally. As part of this effort, the 2012 annual report gives an overview of our activities that is more detailed than in previous years. In compiling the report we have endeavoured to document the impact of our programs and our research community. I continue to be amazed by the quality and energy of our researchers. They deserve our full support, and AARMS plays a vital role in fostering their talent.

For AARMS' newest program, the Collaborative Research Groups (CRG) program, this was the first full year. The groups gave the first of two annual reports of their activities. An excerpt of these reports is included here. It is clear from the reports that the three CRGs that are currently funded represent three strong research groups in the Atlantic region. The funding from AARMS has been used to invite international guest lecturers to give specialized mini-courses, to give undergraduate students a taste of research through summer research projects, to award a student prize, and for a number of other research activities. This program has given AARMS the opportunity to stimulate research groups that are especially active. The current CRGs will finish their term in 2013, and new applications to the program have been solicited.

The summer school is our flagship program, now in its eleventh year. In late 2011 and early 2012, we held a review of this program. The review was led by a group of mathematicians, three from the Atlantic region and one from outside. Their final report was based on interviews with school directors, students, and several members of the AARMS community. I am happy to report that the review was generally positive, though some useful suggestions for improvement were given. These suggestions have all been implemented, and will help improve the organization and impact of the summer school.

This year's summer school was held at Memorial University for the second year. Credit-earning graduate courses in Combinatorics and Algebra were given by prominent guest lecturers. The school had great participation from Atlantic students, and also attracted good students from the rest of Canada and from abroad. Two advanced undergraduate students who attended the school consequently decided to enroll in graduate studies at Memorial University. Two of the courses led to manuscripts submitted to our book series, and a research collaboration between a school director, two lecturers, and students resulted in a paper submitted for publication. In addition, the school was followed by a workshop in Algebra in which

two of the lecturers and eight of the students participated. In short, the summer school amply fulfilled its goal of being a focal point for research and advanced education.

AARMS supported 18 research events and 4 outreach events this year. The events greatly differed in scope and size, ranging from a large formal meeting with multiple concurrent sections and over 300 participants to small specialized and collaborative workshops with 20—30 participants. There is high participation in almost all of our scientific events by researchers from outside the region, both from Canada and abroad. Many were collaborative ventures by researchers from different parts of Canada. The outreach events were equally diverse, comprising a math camp, a public lecture, a math competition and a series of school visits. AARMS is proud to support activities that help motivate and recruit the next generation of mathematicians.

The competition for our post-doctoral program (PDF) was fierce, with over 20 high quality applicants. Due to an imbalance between the number of continuing PDFs and the share of the budget dedicated to the PDF program, only one new PDF was awarded. The winning candidate, Charles Paquette, also received a provincial fellowship from Quebec, further proof of his excellence. In conversation, researchers from the region have emphasized the importance of the AARMS PDF program. As part of the budgeting exercise the AARMS Executive recommends awarding two new fellowships annually, keeping the total number of AARMS post-doctoral fellows to four.

AARMS has been able to maintain and develop its programs thanks to the support of its member universities, the provinces of New Brunswick and Nova Scotia, and the institutes CRM, Fields and PIMS. We wish to thank our donors for their continued support. In addition, I would like to thank the directors of CRM, Fields and PIMS for their support and guidance, which they gave both in their role as Board members and in informal discussions. I also would like to thank all the individuals that helped shape and develop our programs: the AARMS Board, the Executive, the Scientific Review Panel, the summer school directors, and many others that have made vital contributions. Finally, I wish to thank David Langstroth, for his efficiency, good cheer and dedication to making the AARMS programs run smoothly.

Jeannette Janssen
AARMS Director
April, 2013

Collaborative Research Groups

AARMS Collaborative Research Groups consist of Atlantic Province University researchers with common research interests who wish to collaboratively develop their research programs. Members of a CRG typically organize intensive workshops, share PDF appointments, coordinate graduate training programs, propose and assist in AARMS summer school programs, jointly supervise graduate students, and carry out other activities supporting their research programs.

AARMS believes that groups of researchers with common research interests can benefit from sharing resources and coordinating activities. Furthermore, CRGs offer young researchers a larger community for growing their research program. AARMS also believes that the critical mass achieved by CRGs will help the Atlantic Provinces to recruit and retain faculty in mathematical sciences, to attract post-doctoral fellows and offer enhanced training programs attracting more graduate students.

In 2012 there were three AARMS Collaborative Research Groups: The Atlantic Algebra Centre, The Collaborative Research Group in Dynamical Systems and The Collaborative Research Group in Mathematical Ecology and Epidemiology. Each has been approved for continuation in 2012-13.

The Atlantic Algebra Centre (AAC)

Members:

Yuri Bahturin (Memorial)
Margaret Beattie (Mount Allison)
Evgeny Chibrikov (Memorial)
Sara Faridi (Dalhousie)
Edgar Goodaire (Memorial)
Alexei Gordienko (Memorial)
Colin Ingalls (new Brunswick)
John Irving (St. Mary's)
Mikhail Kotchetov (Memorial)
Eduardo Martinez-Pedroza (Memorial)
Mitja Mastnak (St. Mary's)
Mike Parmenter (Memorial)
Roman Smirnov (Dalhousie)
Hugh Thomas (New Brunswick)
Hamid Usefi (Memorial)
Yiqiang Zhou (Memorial)

The Atlantic Algebra Centre came into existence on September 1, 2006, and has been funded as an AARMS Collaborative Research Group since 2011. The goal is to promote research in Algebra and applications in the Atlantic Provinces of Canada, with Memorial University of Newfoundland (MUN) as the central location. The work of the Atlantic Algebra Centre is overseen by an Advisory Board of eminent mathematicians: Yuri I. Manin (Director of the Max Planck Institute for Mathematics in Bonn and Trustee Chair and Professor of Mathematics at Northwestern University), Sudarshan K. Sehgal (Professor of Mathematics at the University of Alberta and

academic father and grandfather of many Canadian algebraists) and Efim Zelmanov (Fields Medalist, Member of the National Academy of Sciences of the United States of America and Rita Atkinson Chair of Mathematics at the University of California - San Diego).

The AAC, under the Administration of Yuri Bahturin reported the publication of 32 papers amongst their faculty members after the first year of funding. This group leverages AARMS funds to obtain matching support from the Department of Math and Stats at Memorial University. The AAC organized international workshops, colloquium talks and mini courses. They also organized an undergraduate algebra competition and a graduate-level competition, and they supported an AARMS Postdoctoral fellow, through other funding.

Winners of the 2012 AAC Undergraduate Algebra Competition Gaelan Hanlon from (UNB) (front left) and Jonathan Lomond (MUN) (front right) presented by MUN Interim Dept Head Edgar Goodaire

In 2012 the AAC was proud to announce the submission of the first book in the AARMS/AMS Book Series written by AAC mini course lecturers Dr Alberto Elduque (University of Zaragoza) and Dr Mikhail Kotchetov (MUN). The title of the book is "Gradings on Simple Lie Algebras".

Mini Courses:

Non-commutative Cryptography - given by Professor Vladimir Shpilrain (City College of New York, NY, USA), February 26 - March 3, 2012.
Growth of Groups and Related Topics - given by Professor Rostislav Grigorchuk (Texas A & M University, USA) May 6 - 12, 2012.
Tropical linear algebra and its applications - given by Professor Alexander Guterman (Moscow State University, Russia) October 1 - 5, 2012.

Workshops:

International Workshop on Groups, Rings, Lie and Hopf Algebras III - held at Bonne Bay Marine Station of Memorial University of Newfoundland in Norris Point, NL, August 12 - 18, 2012.

Most Significant Publications:

- **Gordienko, A. S.** Amitsur's conjecture for polynomial H-identities of H-module Lie algebras. Trans. Amer. Math. Soc., to appear
- **Lomond, J.** Growth functions of F_r-sets. Serdica Math. J. 38 (2012), 463–472
- **Rangipour, B., Sutlu, S.** A van Est isomorphism for bicrossed product Hopf algebras, Comm. Math. Phys., 311 (2012), no.2, 491–511
- **Thomas, H.** K-theoretic Schubert calculus for OG(n,2n+1) and jeu de taquin for shifted increasing tableaux. (with Yong, A. and Clifford, E.) Journal für die Reine und Angewandte Mathematik, to appear.
- **Zhou, Y.** Modules which are invariant under automorphisms of their injective hulls. (with Lee, T.-K.) J. Algebra Appl. 12 (2013), no. 2, 1250159.

The Collaborative Research Group in Dynamical Systems

Members:

Johan Brannlund (Cape Breton)
Alan Coley (Dalhousie)
David Iron (Dalhousie)
Theodore Kolokolnikov (Dalhousie)
Ryan Lukeman (St. F.X.)
Robert van den Hoogen (St. F.X.)

Dynamical systems is a very active field of study. It encompasses many applications to such diverse fields as cosmology, population dynamics and cell biology, to give just a few examples. Many advanced techniques from all areas of mathematics are often brought to bear on these and other problems; the interaction between dynamical systems and underlying applications often yields unexpected insights in either mathematics or its application. A collaborative research group in dynamical systems represents a timely and exciting opportunity with many potential benefits to a wide group of researchers throughout the Atlantic provinces.

Members of the Collaborative Research Group in Dynamical Systems attend the BIRS workshop "Emergent behaviour in multi-particle systems with non-local interactions" in January, 2012

Under the administration of Theodore Kolokolnikov this group reported a very good first year. The funding for the CRG was instrumental especially in supporting undergraduate research: they spent 60% ($7200) of the grant to support five undergraduate summer research projects. There were 10 papers published and 5 submitted by the members of the group during this year. Most of these papers were authored in collaboration with students or visitors who were in part supported by the CRG.

Visitors to the group included David Uminsky (UCLA), Hui Sun (UCLA), Johan Brannlund (Concordia), Peter van Heijster (Boston), Alan Lindsay (Heriot-Watt, UK). Future plans include expanding collaborations, including financial links with the UCLA group.

The 2012 CAIMS/PIMS Early Career Award in Applied Mathematics was awarded in 2012 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

Most Significant Publications:

- A. Coley and W. C. Lim, Generating matter inhomogeneities in general relativity, Phys. Rev. Lett. 108, 191101 (2012)
- A. Coley, J. Brannlund and J. Latta, Unimodular Gravity and Averaging , J. Modern Phys. , 3 pp.266-270 (2012).
- C. Levy, D. Iron, Model of cell signal transduction in a three-dimensional domain, J. Math. Bio, 63, pp 831-854, (2011)
- James von Brecht, David Uminsky, Theodore Kolokolnikov and Andrea L. Bertozzi, Predicting pattern formation in particle interactions , M3AS, vol. 22, Supp. 1, 1140002, 2012
- R. C. Fetecau, Y. Huang and T. Kolokolnikov, Swarm dynamics and equilibria for a nonlocal aggregation model Nonlinearity, Vol. 24, No. 10, pp. 2681-2716 (2011).

The Collaborative Research Group in Mathematical Ecology and Epidemiology

Members:

Lin Wang (New Brunswick)
James Watmough (New Brunswick)
Andy Foster (Memorial)
Chunhua Ou (Memorial)
Yuan Yuan (Memorial)
Xiaoqiang Zhao (Memorial)
Frithjof Lutscher (Ottawa)
Xingfu Zou (Western Ontario)
Wendi Wang (Southwest U., China)

The AARMS collaborative research group in Mathematical Ecology and Epidemiology was formed in 2011 to build on research ties in Mathematical Biology between groups at the University of New Brunswick and Memorial University, Newfoundland. Although the group is centred at these two Atlantic Canadian Universities, it has an international membership. The group has had an active and productive year, with several visitors and a successful summer minicourse. Wendi Wang, from Southwest University, Chongqing, China, visited the group at Memorial University. In March, Mark Lewis, from the University of Alberta, visited the group at UNB Fredericton and gave the annual Ken Ireland Memorial Lecture. At the same time, Yuxiang Zhang and Zhen Wang, graduate students from Memorial, also visited UNB, gave seminars and attended the Ireland lectures. During the week of August 13, Prof. Junping Shi, from the College of William and Mary, delivered a set of excellent lectures for a Summer Mini-Course on Bifurcation Theory and its Applications at the University of New Brunswick. The lectures covered an introduction to bifurcation theory and its application to problems in ordinary, partial and delay differential equations arising from biological applications. Fourteen graduate students and postdoctoral fellows from Laurier, Memorial, Western, York and UNB participated the mini course. At the end of the course, two excellent group projects were presented and a joint paper by participants is in preparation. Following the mini-course, most of the participants went together to the AARMS workshop on Mathematical Biology held at Dalhousie University. The group is proposing to continue with a second mini-course and more visitors in 2012/2013.

<u>Academic Visitors:</u>

Wendi Wang (Southwest U., China)
Junping Shi (William& Mary, USA)
Mark Lewis (Alberta)
Yuxiang Zhang (Memorial)
Zhen Wang (Memorial)

Most Significant Publications:

- Hongying Shu and Wang, L., (2012) “Role of CD+4 T-cell proliferation in HIV infection under antiretroviral therapy, J. Math. Anal., accepted.

AARMS Summer School

The eleventh AARMS Summer School took place at the St. John's campus of Memorial University of Newfoundland from July 16 to August 10, 2012 under the direction of Mikhail Kotchetov and David Pike. As usual, four courses at the beginning graduate level were offered, two in Combinatorics and two in Algebra:

- **Combinatorial Designs and Graph Decompositions**
  Instructor: Darryn Bryant (University of Queensland)
- **Probabilistic Method and Random Graphs**
  Instructor: Pawel Pralat (Ryerson University)
- **Lie Theory**
  Instructor: Alberto Elduque (University of Zaragoza, Spain)
- **Hopf Algebras and Applications**
  Instructors: Nicolas Andruskiewitsch (University of Cordoba, Argentina) and Leandro Vendramin (University of Buenos Aires, Argentina)

Instructor Bios:

Darryn Bryant (University of Queensland) is interested in a branch of mathematics called combinatorics that studies arrangements, patterns, and combinations of discrete objects. A two-time recipient of an Australian Research Council QEII Fellowship, and recipient of the Hall Medal from the Institute of Combinatorics and its Applications, Professor Bryant has solved several important problems in design theory and graph theory. Professor Bryant has supervised many successful RHD students and he has collaborated with people involved in drug discovery, in DNA sequence work, and in other areas of bioinformatics.

Pawel Pralat (Ryerson University) - Over the last five years Dr. Pralat has written over 70 research papers, some of them appearing in such prestigious journals as *Combinatorica* and *Random Structures and Algorithms.* He has worked with 54 co-authors: among them, mathematicians, computer scientists, and social scientists. He draws upon a wide academic background. In Poland, at the University of Lodz and at the Adam Mickiewicz University, he took graduate degrees with a focus on financial

mathematics, computer science (theoretical and applied), and random graph theory; he has collaborated in projects with Motorola, Google, Yahoo! Research, Telefonica, and Microsoft Research, and is currently building connections with Facebook.
Alberto Elduque (University of Zaragoza, Spain) held previous positions at the Universities of Zaragoza and La Rioja and has held visiting positions at the Universities of Wisconsin-Madison, Metz and Pau (both in France). His research focuses on Nonassociative Algebras, with a stress on not necessarily unital composition algebras and their interactions with Lie algebras and superalgebras. He has authored and co-authored more than one hundred papers. Dr. Elduque has advised six doctoral students and is an editor of Communications in Algebra and of Journal of Generalized Lie Theory and Applications.
Nicolas Andruskiewitsch (University of Cordoba, Argentina) is a renowned mathematician whose research interests belong to the rapidly developing area of Hopf Algebras. His results have been published in the most prestigious mathematical journals, including Annals of Mathematics, Advances of Mathematics, Journal of Alebra, Proceedings and Transactions of AMS, Canadian Journal of Mathematics and several Journals of Mathematical Physics.
Leandro Vendramin (University of Buenos Aires, Argentina)

Altogether, 39 students enrolled in courses, typically two each. Fifteen students were from the target group of Atlantic-Canadian universities, with six more from elsewhere in Canada. Other students came from Belgium, Israel, Italy, Poland, Russia, Turkey and the USA. Various social activities complemented our programme, including a welcoming orientation and reception on July 15, an introductory walk into downtown on July 16, a hike from Cape Spear to Fort Amherst on July 21, an excursion to Bay Bulls and the Witless Bay Ecological Reserve on July 28, and a walk to Quidi Vidi, Signal Hill and the Johnson Geo Centre on August 5. Edgar Goodaire also hosted a barbecue on August 4.

"My experience at Memorial University this summer for the program was extremely positive. Thanks so much for telling me about the program."

- summer school student

"[undergrad students who attended the 2012 Summer School] Gaelan Hanlon (UNB) and Kathleen Barnetson (Victoria) are now both Masters students here at MUN"

- David Pike, Summer School Co-Director

Innovations this year included a more rigorous selection process requiring academic transcripts and written references; and we changed the emphasis expressed in some of the announcements for the Summer School. In the past, the intended audience has been described as "graduate and exceptional undergraduate

students." This year we deliberately changed the wording to “exceptional undergraduate students and graduate students", with the intent being to place undergraduate students first and to give the impression that they are anything but an afterthought. It is hard to judge the impact that this slight change had, but of the 39 students who attended in 2012, 15 were undergraduate students (7 from within Atlantic Canada and 8 from elsewhere). It is hoped that attracting talented undergraduate students to participate in the Summer School will have a positive effect on the future graduate student recruitment efforts within the region.

This year we also had two special events associated with the Summer School. One was a public lecture given by Professor Elduque on July 26. The other was a workshop “Groups, Rings, Lie and Hopf Algebras. III" organized by the Atlantic Algebra Centre (AAC) at the Bonne Bay Marine Station of Memorial University (Norris Point, NL) on August 13 - 17. Eight students and two instructors of the Summer School attended the workshop. Five of these students gave research talks.

Finally, a paper titled "Brushing without capacity restrictions" has since been submitted to a journal and is presently being refereed. The authors are D. Bryant, N. Francetic, P. Gordinowicz, D. Pike and P. Pralat [one summer school director, 2 summer school instructors, 1 summer school student, and another collaborator].

Participants at the 2012 AARMS Summer School

List of Students

Yusuf Alagöz	Izmir Institute of Technology	Turkey
Sarah Aljaryan	Memorial University of Newfoundland	Canada
Dilara Altan	Izmir Institute of Technology	Turkey
Kathleen Barnetson	University of Victoria	Canada
Aryan Bayani	Université de Montréal	Canada
Giuliano Bianco	University of Ferrara	Italy
Ruqian Chen	Amherst College	USA
Micha l Eckstein	Jagiellonian University	Poland
Aysel Erey	Dalhousie University	Canada

Nursel Erey	Dalhousie University	Canada
Aras Erzurumluo§glu	Auburn University	USA
Nevena Francetic	University of Toronto	Canada
Adam Gardner	Memorial University of Newfoundland	Canada
Weichen Gu	University of Michigan	USA
Sadegheh Haghshenas	Memorial University of Newfoundland	Canada
Gaelan Hanlon	University of New Brunswick	Canada
Chetak Hossain	University of California - Berkeley	USA
Geoffrey Janssens Vrije	Universiteit Brussel	Belgium
Jonny Lomond	Memorial University of Newfoundland	Canada
Robert Luther	Memorial University of Newfoundland	Canada
Austin MacDonald	St Francis Xavier University	Canada
Sergey Malev	Bar Ilan University	Israel
Tomasz Miller	Warsaw University of Technology	Poland
Leta Dawn Montopoli	University of Guelph	Canada
Joanna Niezen	University of Victoria	Canada
Gabriel Pretel	University of Wisconsin, Madison	USA
Elham Roshanbin	Dalhousie University	Canada
George Shakan	Worcester Polytechnic Institute	USA
Shadi Shaqaqha	Memorial University of Newfoundland	Canada
Kirill Shchegelskiy	Moscow State University	Russia
Matthew Sullivan	Memorial University of Newfoundland	Canada
Yashar Tavakoli	Memorial University of Newfoundland	Canada
Christopher van Bommel	St Francis Xavier University	Canada
Dilek Varol	Dokuz Eylül University	Turkey
Josh Wen	University of California - Berkeley	USA
Rory Wilson	Dalhousie University	Canada
Chao Xu	SUNY - Stony Brook	USA
Liaosha Xu	Illinois Institute of Technology	USA
Vivija Ping You	Ryerson University	Canada

The twelfth annual Summer School will run July 15 to August 9, 2013 at the St. John's campus of Memorial University of Newfoundland We will be offering the following courses:

- **Stochastic Modeling with Applications in Biology**
  Instructors: Drs. Linda Allen and Edward Allen, Texas Tech University, USA
- **Reaction-Diffusion Equations and Applications**
  Instructor: Dr. Stephen Cantrell, University of Miami, USA
- **Mathematical Methods to Gain Biological Insights**
  Instructor: Dr. Odo Diekmann, Utrecht University, The Netherlands
- **Mathematical Modelling in Developmental Biology and Medicine**
  Instructor: Dr. Philip Maini, University of Oxford, UK

AARMS Summer School Review

In the spring of 2012, the committee reviewing the AARMS Summer School Program made its report to the Executive concerning their the overall impression of the program, the strengths and weaknesses of the program, and opportunities for improvement. The report was generally positive, but it raised some issues which could be improved. Taking this advice the Executive took a proposal to the Board with three main components:

- Maintain the four week format
- Limit the external students
- Implement more formal planning process

This proposal was approved and is being implemented into the planning for 2013. The Summer School Review Committee was:

Robert Dawson, St. Mary's University
Margo Kondratieva (Chair), Memorial University
Peter Russell, McGill University
James Watmough, University of New Brunswick

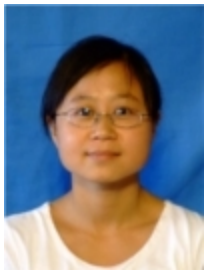
AARMS Postdoctoral Fellowship Program

In 2012 one new AARMS Postdoctoral Fellowship was awarded:

Charles Paquette, received his Ph.D. in 2010 at the Université de Sherbrooke. As an AARMS PDF, he is working at the UNB under the supervision of Drs Hugh Thomas and Eddy Campbell. His research interests focus on representation theory of associative algebras. His last projects dealt with Auslander-Reiten theory, representation theory of infinite quivers, homological conjectures and semi-invariants of quivers.

Other AARMS Postdoctoral Fellowships held in 2012:

Rogers Mathew received his Master of Engg. degree (2007) and PhD(2012) in Computer Science from the Indian Institute of Science, Bangalore, India. He worked as an ARMS PDF at the University of Dalhousie under the supervision of Prof. Jeannette Janssen. His research interests are in graph theory and combinatorics.



Hongying Shu received her PhD from Harbin Institute of Technology (China) in 2010. She worked as an AARMS PDF at the University of New Brunswick under the supervision of Lin Wang and James Watmough. Her research focuses on modeling, analysis and simulations of models in biology, epidemiology, immune system, and gene and neural networks.

Ryan Tifenbach received his PhD from the Hamilton Institute, National University of Ireland, Maynooth, under the supervision of Steve Kirkland. He worked with Danny Dyer at Memorial University as an AARMS Postdoc. His research interests include combinatorics and linear algebra, with a special focus on eigenvalues and graphs.

Francis Valiquette obtained his Ph.D. in 2009 from the University of Minnesota and from 2009-11 he was an NSERC of Canada Postdoctoral Fellow at McGill University. As an AARMS PDF he worked under the guidance of Professor Robert Milson at Dalhousie University. His research deals with the theory and applications of transformation groups and their invariants to problems coming from geometry and mathematical physics.

The competition for 2013 positions opened in November 2012 with final decisions on awards expected in spring 2013. We have the budget to offer two Postdoctoral positions in 2013.

Past holders of AARMS Postdoctoral Fellowships have gone on in many cases to continue in successful careers in mathematics.

Past Postdoctoral Fellows:

Evgeny Chibrikov, Memorial 2009-11 – Currently working in industry in St. John's
Alin Ciuperca, *UNB 2009-11* – Currently working in the Financial sector in Toronto
Kia Dalili, *Dalhousie 2005-07* - Currently working at the Stevens Institute of Technology in Hoboken,New Jersey
Mahya Ghandehari, *Dalhousie 2010-12* - Currently Assistant Professor, U. of Saskatchewan
Alexei Gordienko, *Memorial 2010-12* - Currently working as a Marie Curie Postdoctoral Fellow at Vrije Universiteit in Brussels
Thomas Guedenon, *Mount Allison 2003-05* – no information
Rebecca Hammond, *Acadia 2007-09* - no information
Sigbjorn Hervik, *Dalhousie 2005-06* - Currently a full professor at the University of Stavanger in Norway.
Daniel Horsley, *Memorial 2008-10* – Currently ARC DECRA Research Fellow in the School of Mathematical Sciences at Monash University
Golam Hossain, *University of New Brunswick 2008-10* – Currently Assistant professor at the Indian Institute of Science and Education in Kolkata.
Tobey Kenney, *Dalhousie 2006-08* - Currently Professor of mathematics at Dalhousie
Dawood Kothawala, *University of New Brunswick 2010-12* – Currently Assistant professor at the Indian Institute of Techology (IIT) in Madras.
Peter LeFanu Lumsdaine, *Dalhousie 2010-12* - Currently holds a postdoctoral position at the Institute of Advanced Studies in Princeton
Ping Wong Ng, *University of New Brunswick 2003-05* – Currently Assistant professor in the Mathematics Department at the University of Louisiana at Lafayette
Rui Peng, *Memorial 2010-12* - Currently is a postdoc in the Institute of Math. and its Applications,
University of Minnesota.
Michael A. Warren, *Dalhousie 2010-11* - Currently holds a postdoctoral position at the Institute of Advanced Studies in Princeton
Oliver Winkler, *University of New Brunswick 2004-06* - Currently Strategic Analyst with Siemens Canada
Dansheng Yu, *Saint Francis Xavier 2006-08* – Currently Associate Professor, Hangzhou Normal University, China

Conferences and Workshops

In 2012 AARMS funded or partially funded the following workshops conferences and events. These involved over 1500 participants, more than 1200 of whom were from outside Atlantic Canada:

Events with Funding from External Sources:

Annual Meeting of the Statistical Society of Canada
Organizers: Brian Allen, Alexendre Leblanc, Tim Swartz, John Brewster
Location: University of Guelph
Date: June 3-6, 2012
Also funded by CRM, Fields, Mitacs, PIMS and the City of Guelph

There were 547 delegates, the composition being 55% regular registrations, 40% students and 5% retired. There were 46 invited sessions with 116 speakers, 34 contributed paper session with 175 speakers and 4 poster sessions with 40 posters. Three one-day workshops were held concurrently on Sunday. There were about 25 participants from Atlantic Canada. The remaining participants were mainly from Canada and the US but with representation from seven European countries, China, Korea, Japan, Australia, South Africa and the Carribean. Travel funding was provided to Ken McRae, Agriculture and AgriFood Canada, Kentville, NS and to three graduate students from Atlantic Canada.

Foundational Methods in Computer Science
Organizers: Peter Selinger, Dorette Pronk
Location: Dalhousie University, Halifax
Date: June 14-17, 2012
Also funded by Dalhousie University

This is an annual workshop bringing together researchers in mathematics and computer science with a focus on the application of category theory in computer science. This year's workshop was organized by Dorette Pronk and Peter Selinger (Dalhousie). The scientific program consisted of four invited tutorials aimed at students and newcomers to category theory, as well as two and a half days of research talks. Among the scientific highlights was a sequence of lectures on connections between type theory and homotopy theory, delivered by Simona Paoli (Leiceister), Peter LeFanu Lumsdaine (AARMS Postdoc), and Laura Scull (Fort Lewis).

SIAM Conference on Discrete Mathematics
Local organizers: Jeannette Janssen, Jason Brown, Richard Nowakowski
Location: Dalhousie University, Halifax
Date: June 18-21, 2012
Also funded by Elsevier, Google, Microsoft and NSF

This meetings is held in North-America every two years. The Society for Industrial and Applied Mathematics (SIAM) supervises the meeting and handlesthe registration, but

the details of the meeting are arranged by the local organizer. The meeting attracted a record number of almost 400 discrete mathematicians, mainly from North-America and Europe. The meeting had eight plenary lectures by leading researchers in the field, as well as 8 concurrent sessions of minisymposia. The talks covered a wide range of topics, ranging from pure to applied, with links with algebra, topology, applied math, and computation. For example, the invited talk by Anders Björner, chaired by Dr. Brown, showed how cell complexes, known from topology, can be applied to combinatorial structures. The invited talk by Balàsz Szegedy, chaired by Dr. Janssen, discussed the application of tools from analysis and probability theory to find relationships between subgraph counts in graphs. The Dènes König prize lecture was held on the evening of the first day, followed by a welcome reception. The prize winner and lecturer was Zeev Dvir from Princeton University. On Wednesday evening, the future of discrete mathematics was discussed at a forward looking session, with four panelists.

Workshop on Algorithms and Models for the Web Graph
Organizer: Jeannette Janssen
Location: Dalhousie University, Halifax
Date: June 21-22, 2012
Also funded by Dalhousie, Microsoft and Ryerson

The goal of the conference was to bring together researchers working on various aspects of real-world, complex networks. Complex networks are all around us, from social networks such as Facebook and Twitter, to the vast network of web pages and their links. WAW is a unique conference focusing on this important topic, and istruly interdisciplinary with participants working in disciplines such as Mathematics, Statistics, Computer Science, Sociology, and Engineering. With over 40 attendees, of which 12 from the Atlantic region, 4 from the rest of Canada, 13 from the US, and 13 from Europe, Australia, and Asia, the conference possessed a truly international character. There were two luminary plenary speakers: Jennifer Chayes (Microsoft Research, New England) and Nelly Litvak (University of Twente, the Netherlands). Chayes spoke on stunning new work on the application of algorithmic game theory to complex network modelling, and Litvak spoke on the pitfalls of degree correlations in both theory and practice.

14th Cdn Conference on General Relativity and Relativistic Astrophysics (CCGRRA 14)
Organizers: Ivan Booth, Hari Kunduri, Benjamin Tippett
Location: Memorial University, St. John's
Date: July 9-12, 2012
Also funded by the Canadian Institute for Theoretical Astrophysics, The Perimeter Institute and Memorial University

The meeting covered the broad range of relativistic research done in Canada including relativistic astrophysics, cosmology, mathematical and numerical relativity, and black holes. The meeting also attracted a number of international attendees, including two prominent mathematical relativists (Sergio Dain and Stefan Hollands) and a leading member of an international collaboration involved in gravitational wave detection (Patrick Brady). The scientific program was based on one-hour plenary invited talks from international scientists, established Canadian researchers, and recent faculty appointments to Canadian universities. Experienced researchers (faculty, postdoctoral fellows) and graduate students contributed 30- and 20 minute talks respectively to specialized parallel sessions. The schedule was arranged so as to allow significant amounts of time for non-lecture interactions between the participants (particularly in the evenings and on Wednesday afternoon).
There were many excellent talks but highlights of the conference included Dain's report on geometric inequalities for dynamical black holes, Hollands' lecture on the relationship between black hole thermodynamics and instabilities, Harald Pfeiffer's talk on numerical simulations of black hole mergers, and Brady's status report on the LIGO gravitational wave detector. Finally, a popular science lecture, held in conjunction with the conference and supported by Memorial University, was a great success with an attendance of approximately 250. Robert Mann's talk on 'The Lighter Side of Black Holes' entertained the public and received local television, radio, and print coverage.

Canadian Undergraduate Mathematics Conference
Organizers: Rodney Earl, Josh Sarada, Faisal Md. Rahman, Andrea Hyde, Spencer Hunt, Crystal Parras, Jodie Foster
Location: UBC Okanagan
Date: July 11-15, 2012
Also funded by CMS, CRM, Canadian Society of History and Philosophy in Mathematics, GoldenKey, Irving K Barber School of Arts and Sciences, PIMS, Maplesoft, Okanagan College, UBC, UNBC

This year marked the 19th Annual Canadian Undergraduate Mathematics Conference (CUMC) with over 150 people attending,including participants, keynote speakers, and volunteers, and over 80 student talks. There were a great variety of student talks this year. Participants attended presentations on combinatorics, mathematical biology, mathematical history, algebras, statistics and probability, topology, and optimization, to name a few. There were also seven keynote speakers from across Canada and as far away as France. They were: Dr. Heinz Bauschke (UBC's Okanagan campus), Dr. Catherine Beauchemin (Ryerson University), Dr. Gerda de Vries (University of Alberta), Dr. Donovan Hare (UBC's Okanagan campus), Dr. Jennifer Hyndman (UNBC), Dr. Dominikus Noll (Université Paul Sabatier, France), and Dr. Tim Swartz (Simon Fraser University).

International Symposium in Statistics
Organizer: Brajendra Sutradhar
Location: Memorial University, St. John's
Date: July 16-18,2012
Also funded by Memorial University

This meeting covering three specialized research areas for longitudinal data analysis was attended by 51 delegates from many countries such as Brazil, Switzerland, Spain, Netherlands, Mauritius, USA and Canada, covering almost the entire globe. The first plenary talk was given by Professor Brajendra Sutradhar on successes and further challenges in the area of longitudinal data analysis when data are subject to measurement error. Other plenary and special invited talks in this area were delivered by Professors Leonard Stefanski from North Carolina State University, T. J. Wansbeek from University of Groningen, Netherlands, and John Buonaccorsi from University of Massachusetts. The second day of the symposium was devoted to the analysis of longitudinal data subject to non-response. The plenary and special invited talks on this theme were delivered by Professors Brajendra Sutradhar from Memorial University, Paul S. Albert from NICHD, Maryland, USA, Richard J. Cook from University of Waterloo, and Michael Daniels from University of Florida. The symposium on its third day dealt with successes and challenges for analysis of longitudinal data possibly contaminated by outliers. The three main talks of the day were delivered by Professors Brajendra Sutradhar, Memorial University, Julio M. Singer from Brazil, and Elvezio Ronchetti from University of Geneva.

24th Canadian Conference on Computational Geometry
Organizers: Greg Aloupis and David Bremner
Location: University of Prince Edward Island, Charlottetown
Date: August 8-10, 2012
Also funded by Fields, Mprime and PIMS

CCCG'2012 took place in Charlottetown, PEI. There were 75 papers reviewed, of which 52 were accepted. There were two sessions held in parallel.
Furthermore, three one-hour invited talks were given. As every year, there was an Open Problem session, attended by all participants. The scientific highlights were the three invited speakers and their lecture topics were: Günter Ziegler (Freie Universität Berlin) “Cannons at Sparrows”; Pankaj Agarwal (Duke University) “Algorithms for Geometric Similarity”; and Joseph Mitchell (Stony Brook University) “Computational Geometry in Air Trac Management”. All presented papers appear in public electronic proceedings on the conference website. Printed proceedings were made available to all participants, and further copies can be purchased from CCCG.
A special issue of the journal Computational Geometry: Theory and Applications will be devoted to a selection of papers from CCCG (expanded versions).

Groups, Rings, Lie and Hopf Algebras III
Organizer: Yuri Bahturin, Mikhail Kotchetov
Location: Memorial University, Bonne Bay Marine Station
Date: August 12-18,2012
Also funded by Memorial University
An Atlantic Algebra Centre event

We had 15 international participants (Argentina, Belgium, Brazil, Israel, Italy, Poland, Spain, USA) and 11 Canadians (9 from Atlantic Canada). A special feature of the workshop was that it was attended by eight students of the AARMS Summer School 2012, which worked for four weeksprior to the Workshop at the Department of Mathematics and Statistics of Memorial University in St. John's. Five of them had their own research results and presented them to the participants of the Workshop as 20 minute research talks. Plenary Lectures were given by Amitai Regev (Weizmann Institute of Science, Israel); Georgia Benkart (University of Wisconsin – Madison); Eric Jespers (Vrije Universiteit Brussel, Belgium); Alberto Elduque (University of Zaragoza, Spain); Dmitri Nikshych (University of New Hampshire); Said Sidki (University of Brasilia, Brazil); Leandro Vendramin (University of Buenos Aires, Argentina).

Two Weeks at Waterloo - A Summer School for Women in Math
Organizers: Barbara Csima and Kathryn Hare
Location: University of Waterloo
Date: August 12-25, 2012
Also funded by CAIMS, CMS, Fields, Manulife, Maplesoft, PIMS and TD

This was a two-week workshop for outstanding female undergraduate mathematics students. The purpose of the workshop was to encourage and inspire talented women students to continue their studies in mathematics and to consider graduate work in mathematics. Two mini-courses were offered, Introduction to elliptic curves, taught by Prof. Matilde Lalin (U. Montreal) and Introduction to math biology, taught by Prof. Gail Wolkowicz (McMaster U.). As part of the courses, the students worked in small groups on a research project. Three guest lectures by prominent women mathematicians were given, including one public lecture, and one lecture was given by a pair of women working in industry. Tours were made to meet with female mathematicians in industry at IBM, Manulife and Maplesoft. The students also visited the Fields Institute. The program was advertised across Canada and 16 women were chosen from over 50 applicants. They came from 7 provinces and 13 different universities, including one from St. Francis Xavier University, supported by AARMS funding. Most were entering their final year of undergraduate studies.

Noncommutative Geometry
Organizers: Colin Ingalls, N. Higson, M. Lesch, B. Rangipour
Location: University of New Brunswick, Fredericton
Also funded by Fields and UNB

This was the second part of a joint conference with the Fields Institute on September 6-7, 2012. We had participants from USA, Ontario, as well as local people from New Brunswick. We had 15 speakers with one hour talk each. The topics of talks included representation theory, deformation theory, K-Theory of C* algebras, foliations and their quantum characteristic classes. The tradition of the CNGT (Centre for Noncommutative Geometry and Topology) is to have a large international conference every other year. The last such conference was in 2010. This was two simultaneous meetings which were held directly after the CMS meeting in Fredericton. They were the 38th Annual Canadian Operator Theory and Operator Algebras Symposium and the CMS Satellite Workshop on Noncommutative Geometry.

Reports from participants included such comments as “This conference was at the level of one at Berkeley or Harvard." The world's leading experts on Index Theory attended these meetings. The idea of having these meetings occur together received lots of positive comments. In Autumn 2012 we repeated this success. The main idea was to take advantage of the variety of research of the members of the centre. We had a multi-dimensional conference pivoted on Noncommutative Geometry. We had about 30 participants in the two parts of the conference in two different areas: Noncommutative Geometry and Noncommutative algebraic Geometry. The conference had two parts and was in two locations. It started with two days at the Fields Institute in Toronto, followed by a two day conference in Fredericton. It is worth mentioning that the centre has a close relation with the Fields Institute and keeps its regular cooperation by having joint activities such as Canadian Bimonthly workshop on NCG.

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
Also funded by Mount Allison and Science Atlantic

The Mathematics, Statistics, and Computer Science Science Atlantic conference is an annual meeting in the Atlantic Provinces, hosted by a different university each year in a roughly 10 year cycle. There are two primary activities: student competitions in mathematics and computer science and research presentations. On Friday roughly 90 students participated in a written mathematics contest and a programming contest. On Saturday we had about 30 oral presentations based on undergraduate and

graduate research projects. Over the two days we hosted three plenary speakers who presented engaging expositions of mathematics, computing, and statistics. There were 110 student (regional participants) and 50 faculty (regional as well) at the Science Atlantic portion of the meeting. We had three plenary speakers who were from Canada, but outside the Maritimes (Montreal, Toronto, Vancouver). The AARMS workshop on Sunday had about 18 participants with about 6 national/international participants.

Combinatorial Theory of Groups and Hopf Algebras
Organizers: Yuri Bahturin, Mikhail Kotchetov
Location: Mount Allison University, Sackville
Date: October 13 - 14, 2012
Also funded by Memorial University
An Atlantic Algebra Centre event

The mini conference was organized as AARMS session of Science Atlantic 2012 Mathematics, Statistics, and Computer Science Conference at Mount Allison University. The mini conference was attended by 3 participants from the US, 1 from New Zealand and 12 from Atlantic Canada. The plenary talks were given by three leading specialists in Combinatorial Theory of Groups and its applications, as follows: Alexander Olshanskii (Vanderbilt University, USA); Olga Kharlampovich (City University of New York, USA); and Alexei Miasnikov (Stevens Institute, USA). Two extended research talks were given by MUN professors Eduardo Martinez-Pedroza and Mikhail Kotchetov. In addition there were three short research talks based on the results of the work of graduate and undergraduate students.

Events Funded solely by AARMS:

Atlantic General Relativity Conference
Organizers: Jack Gegenberg, Viqar Husain, Ivan Booth
Location: University of New Brunswick, Fredericton
Date: April 28-29, 2012

The conference was attended by a good percentage of those researchers in the Atlantic Canada region working in the area of classical and quantum gravity. Besides the faculty members in attendance, there were a number of students and postdocs. Many of the talks concerned problems in quantum gravity, arguably the frontier of theoretical/mathematical physics. In particular V. Husain discussed his exciting new approach of the dust time gauge, which leads to tractable models of quantum gravity. As well, D. Sloan described his work using Loop Quantum Cosmology to describe

how ination `turns o'. Finally, A. Kreienbuehl set out his results showing that quantum gravity can resolve the singularities in cosmology.

East Coast Combinatorics Conference 2012
Organizer: Danny Dyer
Location: Memorial University, St John's
Date: May 9-11, 2012

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

Workshop on Mathematical Biology
Organizers: David Iron, Theodore Kolokolnikov, James Watmough, Sina Adl
Location: Dalhousie University
Date: August 18-19, 2012
A CRG in Mathematical Ecology and Epidemiology event

Atlantic Conference on Dynamical Systems
Organizers: Alan Coley, David Iron, Theodore Kolokolnikov
Location: Dalhousie University
A CRG in Dynamical Systems event

AARMS Publications

A Manuscript by Dr Alberto Elduque (University of Zaragoza) and Dr Mikhail Kotchetov (MUN) entitled "Gradings on Simple Lie Algebras". has been accepted for publication by AARMS and AMS, and will be published as an AARMS-AMS book in the Mathematical Surveys and Monographs series. Elduque was a lecturer at the 2012 summer school.

AARMS actively encourages summer school lecturers to develop the notes for their lectures into a book. In 2012, one such manuscripts was submitted by Pawel Pralat, based on his course on “Probabilistic Method and Random Graphs”

Also of note was the fifth issue of the **Atlantic Electronic Journal of Mathematics** (AEJM) published in summer 2012. The AEJM is a refereed online journal for articles in mathematics and related disciplines. The primary purposes are to give students (both graduate and undergraduate) a venue for publishing papers

and to publish articles from established researchers at a level suitable for students. Each article is refereed by professional mathematicians to ensure a high publication standard. The final decision for publication is made by the editors. While original research results are not required, high quality in exposition and content are required. The AEJM publishes new results, new perspectives on known results, historical aspects of mathematics, relationships between areas of mathematics (or other areas of study), or interesting applications of mathematical ideas or techniques. http://euclid.trentu.ca/aejm/index.htm

Outreach

In 2012 AARMS supported the following outreach programs:

Enhancing Our Appreciation of Mathematics Through Intentional Community Outreach

- A program for developing public appreciation of mathematics: by creating a recreational mathematics exhibit, staffed by volunteers from the UNB Faculty of Education that will be displayed in libraries; by implementing a public lecture series in the Fredericton Library; and by interactive visits to schools. Organized by John Grant McLoughlin (UNB).

UNB-CMS Mathematics Camp, Grades 10-11 – A long weekend of mathematical activities for grade 10 and 11pupils presented by the faculty, students and staff of the UNB Dept of Mathematics and Statistics in Fredericton. Organized by Daryl Tingley

The New Brunswick Mathematics Competition, Grades 7-9 – Carried out at the University of New Brunswick (Fredericton) and l'Université de Moncton, this is a one-day event to encourage students with an interest and ability in mathematics and to introduce them to university mathematics. Organized by Maureen Tingley and Paul DeGuire.

The Blundon Seminar – A three-day event held at Memorial University in St. John's for students who have performed well in various national and provincial math competitions. It consists of lectures, problem-solving sessions and other fun activities. Organized by Margo Kondratieva.

Mathematics of Planet Earth

In 2012 AARMS initiated a planning process for a number of activities to occur in 2013, which is given the international theme: The Mathematics of Planet Earth. These will include:

The AARMS Summer School

The 2013 AARMS Summer School will present four courses on the MPE theme - two in Mathematical Biology and two in Dynamical Systems. There will also be an associated workshop in Mathematical Biology (see below).

Public Lectures

In collaboration with the CMS, AARMS is sponsoring three public lectures:

- **Gilbert Brunet**, The Mathematical Challenges of Earth-System and Weather Prediction, St. John's, NL, March 19, 2013.
- **Walter Craig**, Ocean Waves, Rogue Waves, and Tsunamis, Fredericton, NB, October 10, 2013.
- **Mary Lou Zeeman**, Harnessing Math to Understand Tipping Points. Halifax, NS, 27 September, 2013

Workshops

2013 Workshop in Mathematical Biology. Organizers: Amy Hurford and Xiaoqiang Zhao. St. John's, July 27-29, 2013.

Sustainability of Aquatic Ecosystems Networks. Organizers: Frithjof Lutscher and James Watmough. Fredericton, April 22-26, 2013. This is part of pan-Canadian thematic program on Models and Methods in Ecology, Epidemiology and Public Health.

Administration and Governance

Jeannette Janssen, Director
Department of Mathematics and Statistics
Dalhousie University

Xiaoqiang Zhao, Deputy Director
Department of Mathematics and Statistics
Memorial University of Newfoundland

David Langstroth, Executive Administrator
Dalhousie University

The AARMS Executive Committee

Jeannette Janssen (Dalhousie), Chair
Jacques Allard (Moncton)
David Bremner (New Brunswick)
David Irons (Dalhousie)
Paul Muir (St. Mary's)
Yuan Yuan (Memorial)
Xiaoqiang Zhao (Memorial)

The AARMS Editorial Board

Yuri Bahturin (Memorial), Chair
Robert Dawson (Saint Mary's)
Theodore Kolokolnikov (Dalhousie)
Lin Wang (New Brunswick)
David Langstroth, Managing Editor (AARMS Executive Administrator)

AARMS is established through a set of statutes signed by the largest university in each Atlantic Province: Dalhousie University, Memorial University, University of New Brunswick and University of Prince Edward Island. These statutes define an organizational structure which includes a Board, an Executive Committee and a Scientific Review Panel.

The Director and Executive Administrator of AARMS are based at Dalhousie University, and the Deputy Director is based at Memorial. The other members of the Executive Committee are drawn from Dalhousie, Memorial, Saint Mary's, the University of new Brunswick and Université de Moncton, a distributed membership which includes large universities and small ones and enables AARMS to be in touch

with current issues through Atlantic Canada and to be in dialogue with researchers in all provinces.

The Board is comprised of major sponsors of AARMS including Directors of the three Institutes and senior administrators from the universities; it also includes representatives of industry members of the Executive Committee and other mathematical scientists. In 2012 we were pleased to welcome several new members to the Board: **Mike Ashar (**President of Irving Oil), **David Burns** (VP Research at UNB), **Robert Gilmour** (VP Research at UPEI), **Jacques Yves Guigné** (President of Acoustic Zoom Inc and Executive Director of Pangeo Subsea), **Viqar Husain** (Chair of Mathematics and Statistics at UNB) and **Henrik Stryhn** (Professor in Biostatistics, Department of Health Management, Atlantic Veterinary College, UPEI).

Our Scientific Review Panel is composed of mathematical scientists from Canada and abroad who are nationally and internationally respected in their fields. This panel assesses applications to our postdoctoral fellowship program, our collaborative research group program, and evaluates the larger requests for funding for workshops and converences. It provides scientific advice when requested.

The AARMS Board

Hermann Brunner, Chair - Professor Emeritus at Memorial University of Newfoundland. He received his Ph.D. in 1969 from ETH-Z (Swiss Federal Institute of Technology, Zurich) and was a faculty member at Dalhousie University, the University of Munster (Germany) and the University of Fribourg (Switzerland) before joining MUN in 1986. He held visiting professorships at the University of Dundee (Scotland), CWI (Centre for Mathematics and Informatics, Amsterdam), ETH-Z and the University of Trieste (Italy), and he is currently a visiting professor at the University of Strathclyde (Glasgow, Scotland) and at Hong Kong Baptist University. From 1999-2005 he was Director of AARMS, and he was elected a Fellow of the Fields Institute in 2006. His main research interests are in the numerical analysis of Volterra functional integral and differential equations.

Mark Abrahams - a behavioural ecologist who studies the risk of predation and its impact upon aquatic ecosystems. This work is of fundamental importance to understanding how ecosystems operate, as well as having application to conservation ecology and invasion dynamics. He worked at the University of Manitoba for 18 years before moving to Memorial University where he is the Dean of Science.

Alejandro Adem - Canada Research Chair and Professor of Mathematics at UBC. He received his Ph.D. in 1986 from Princeton University and after a postdoctoral position at Stanford University he became a faculty member at the University of Wisconsin-Madison before moving to UBC in 2004. He has been Director of PIMS since July 2008. His research interests are primarily in algebraic topology and group cohomology.

Jacques Allard - Professor of Statistics at Université de Moncton. He received his Ph.D. from UBC and held post-doctoral positions at Oxford University and Université de Montréal. He has been professor at Université de Moncton since 1979 where he was also chair of the Département de mathématiques et de statistique from 2000 to 2006. Most of his research is in applied statistics with an emphasis on fisheries management application. He has also been a consultant to the private and public sectors since 1984.

Mike Ashar is the President of Irving Oil. Since July 2008, Mike has led the operations of our Refining, Commercial, and Marketing businesses. With senior executive experience in all aspects of the energy industry, Mike has overseen refining and marketing operations throughout Canada and the US. As the former executive vice-president of Suncor Energy Inc., he managed operations and major capital growth projects in the oil sands and held many senior operating and corporate roles. Mike holds a BA (Philosophy and Economics), BASc (Chemical Engineering), and MBA from the University of Toronto. He continues to serve as an Independent Director of Teck Resources Limited. A committed member of the communities in which he has lived and worked, Mike is particularly devoted to education, athletics and wellness. He was instrumental in establishing an eMBA program for Irving Oil employees in partnership with the University of New Brunswick. Mike also initiated health and wellness programs for Irving Oil employees and served as Co-Chair of the 2004 Arctic Winter Games. Mike and his wife, Maryalice, have four children.

Edward Bierstone - Director of the Fields Institute and Professor in the Department of Mathematics, University of Toronto. He earned his B.Sc. from the University of Toronto (1969) and his Ph.D. from Brandeis University (1973). He has held visiting positions at the Institute for Advanced Study (Princeton), l'Institut des Hautes Etudes Scientifiques (Bures-sur-Yvette) and IMPA (Rio de Janeiro). Ed's honours include Fellowship in the Royal Society of Canada (1992), an invited address at the American Mathematical Society Annual Meeting (1997), the Jeffery-Williams Prize of the Canadian Mathematical Society (2005), and the Excellence in Teaching Award of the CMS (2008). Ed has made groundbreaking contributions in the areas of algebraic geometry and singularities of differentiable functions. His work on resolution of singularities (in collaboration with Pierre Milman) has played a major part in a revival of activity in the area; the constructive techniques involved have led to applications in fields as diverse as logic and analysis.

David Bremner - David Bremner holds Ph.D. in Computer Science from McGill University (1997). David was an NSERC postdoctoral fellow in the Department of Mathematics at the University of Washington from 1997 to 1999. Since 2000 David has been a faculty member at the University of New Brunswick, and is currently a Professor of Computer Science (cross-appointed to the Department of Mathematics and Statistics). David has held visiting positions at the Technical University of Munich (as an Alexander von Humboldt Fellow), the Hausdorff Research Institute for Mathematics. He is currently the MITACS Atlantic Scientific Director. David's main research interests are in geometric aspects of optimization, particularly algorithmic problems about convex polyhedra and hyperplane arrangements.

awaiting image

David Burns - Vice-President Research, UNB.

Hugh Chipman - Hugh Chipman is interested in computationally intensive statistical methods, including Bayesian computation, statistical and machine learning, and applications involving network data, drug discovery, and industrial statistics. He is a professor and Canada Research Chair at Acadia University's Department of Mathematics and Statistics. He received his doctorate at the University of Waterloo, and has held academic positions at the University of Chicago and the University of Waterloo.

Robert Gilmour - currently is Vice President, Research at the University of Prince Edward Island. He formerly was a Professor of Physiology in the Department of Biomedical Sciences and Associate Dean for Research and Graduate Education at Cornell University, where he led a multidisciplinary group of investigators whose publications have appeared in both cardiovascular and physics journals. He also was a member of the Executive Committee for the IGERT-sponsored program in non-linear systems at Cornell and was a member of the Graduate Fields of Physiology, Pharmacology, Bioengineering and Computational Biology. His research interests are centered on theoretical and experimental studies of heart rhythm disorders. .

Jacques Yves Guigné - serves as the Founder and President / Board Director of Intelligent Sciences Ltd. and Co-Founder, Director and Board member of PanGeo Subsea Inc. and of Acoustic Zoom Inc. (Jacques is the President and Chief Scientist/ Geophysicist for Acoustic Zoom Inc. and Executive Director and Chief Scientist/Geophysicist for PanGeo Subsea Inc.).

Viqar Husain - Professor in the Department of Mathematics and Statistics at the University of New Brunswick (Fredericton), and Affiliate Researcher at the Perimeter Institute since its founding. He received his PhD in theoretical physics from Yale University (1989). His fields of research are general relatively, cosmology, and quantum gravity. He has been Department Chair since 2007 and was Director of AARMS from 2008-2011.

David Iron - Assistant Professor at Dalhousie University. He received his PhD in Applied Mathematics at the University of British Columbia in 2001. His primary area of research is pattern formation in reaction-diffusion systems. Specifically, he studies the stability and dynamics of highly localized structures in these systems. In addition, he has collaborated with experimentalist in Chemistry and Biology.

Jeannette Janssen - **Director of AARMS**, Professor in the department of Mathematics & Statistics at Dalhousie University. She is a graph theorist, using techniques from probability and combinatorial optimization in her research. Her current interests focus on the modelling of complex networks, such as the networks of contacts formed through social media. She is one of the project leaders of the MITACS project: Modelling and Mining of Networked Information

Spaces (MoMiNIS). Jeannette obtained her PhD in 1993 from Lehigh University in Pennsylvania, and her first graduate degree (doctoraal diploma) in 1988 from the Technical University Eindhoven in the Netherlands.

François Lalonde - Director of CRM, a mathematician and physicist by training, Francois Lalonde holds a Doctorat d'État (1985) from the Université de Paris-Sud Orsay in the field of differential topology. His fields of interests include symplectic topology, Hamiltonian dynamics and the study of infinite-dimensional groups of transformations. He is member of the Royal Society of Canada since 1997 and was a Killam Research Fellowship recipient in 2000-2002. He holds the Canada Research Chair in the field of Symplectic Geometry and Topology at the Department of Mathematics and Statistics of Université de Montréal. Plenary speaker at the First Canada-China congress in 1997, part of his works in collaboration with Dusa McDuff was presented in her plenary address at the ICM 1998 in Berlin. He was an invited speaker at the ICM 2006 in Madrid.

Paul Muir - Professor, Department of Mathematics and Computing Science, Saint Mary's University. He received his Ph.D. from the University of Toronto in 1984 in Computer Science (Numerical Analysis). Dr. Muir's research is in the general area of numerical analysis; his specialties include the numerical solution of ordinary differential equations, with emphasis on boundary value ordinary differential equations and Runge-Kutta methods, and the adaptive method-of-lines solution of partial differential equations with collocation methods.

John Newhook - Associate Vice-President Research, Dalhousie University. He is a Professor in the Department of Civil and Resource Engineering and the Director of the Centre for Innovation in Infrastructure. He obtained a PhD in Civil Engineering from Dalhousie in 1997. His research interests are in the areas of structural health monitoring, bridge engineering and analysis, soil-structure interaction and modelling, and the use of advanced composite materials in infrastructure.

Henrik Stryhn - Professor in Biostatistics, Department of Health Management, Atlantic Veterinary College (AVC), University of PEI. He received his PhD from the Royal Veterinary and Agricultural University of Denmark (now part of the University of Copenhagen) in 1994. A statistician by training, he has been working extensively with applications of statistics in agriculture and veterinary science. Dr. Stryhn emigrated from his native Denmark to Canada in 2001 to take

up a position at AVC. His research interests include a broad range of methods in statistics and epidemiology, in particular models involving random effects and other latent variables.

Yuan Yuan - Professor at Memorial University of Newfoundland. She received her PhD in Applied Mathematics at the University of Western Ontario in 2002. Her research interests include Applied Dynamical Systems, Functional Differential Equations and Applications.

Xiaoqiang Zhao - Deputy Director of AARMS, University Research Professor at Memorial University of Newfoundland. He received his PhD in Applied Mathematics from Chinese Academy of Sciences in 1990. His research interests are Applied Dynamical Systems, Nonlinear Differential Equations, and Mathematical Biology.

awaiting image

Ke Hua Zhou - New Brunswick Investment Management Corporation.

The AARMS Scientific Review Panel

Xiaoqiang Zhao, Chair - Deputy Director of AARMS and University Research Professor at Memorial University of Newfoundland. He received his PhD in Applied Mathematics from Chinese Academy of Sciences in 1990. His research interests are Applied Dynamical Systems, Nonlinear Differential Equations, and Mathematical Biology.

Yuri Bahturin - University Research Professor at the Department of Mathematics and Statistics, Memorial University of Newfoundland, Coordinator of the Atlantic Algebra Centre, and Chair of Higher Algebra at the faculty of Mechanics and Mathematics, Moscow State University. His main occupation is research, supervising and teaching in algebra. He has published more than 100 books and papers, supervised 15 PhDs and more than 20 MSc students.

Michael Bennett - is professor and head of the Department of Mathematics at the University of British Columbia, where he has been a faculty member since 2001, and from where he obtained his PhD in 1993. Previously, he held positions at the University of Waterloo, the University of Michigan, The Institute for Advanced Study, Princeton, and at the University of Illinois, Urbana-Champaign. He has served on the Board of Directors of the Canadian Mathematical Society as Vice President (West) and currently serves on the board of the Number Theory Foundation. His main research interests are in Number Theory, where he has published extensively.

Chen Greif - is a professor of computer science at the University of British Columbia, where he holds a faculty position since 2002. He received B.Sc. and M.Sc. degrees in applied mathematics from Tel Aviv University, and obtained his PhD (applied mathematics) from UBC in 1998. Before joining UBC as a faculty member he was a postdoctoral fellow at Stanford University (1998-2000) and a Senior Software Engineer at Parametic Technology Corporation (2000-2002). He is an Associate Editor with the SIAM Journal on Scientific Computing, and the Program Director of the SIAM Activity Group on Linear Algebra. His main area of interest is scientific computing, and in particular numerical linear algebra.

Penny Haxell - is a professor in the Department of Combinatorics and Optimization at the University of Waterloo, where she has been a faculty member since 1993. She received a BMath degree from Waterloo in 1988, and a PhD from the University of Cambridge in 1993. She has served on the Board of Directors of the Canadian Mathematical Society, and as managing editor of the Journal of Combinatorial Theory, Series B. Her main interests are extremal combinatorics and graph theory.

Javad Mashreghi - is a Professor of Mathematics at Laval University. He obtained his bachelor degree in electrical engineering from the University of Tehran, and his Ph.D. in pure mathematics from McGill University in 2001. He has served in the board of directors of the Canadian Mathematical Society (CMS) and Centre de Recherches Mathématiques (CRM), and faculty Council of the Faculty of Science and Engineering of Laval University. He has published 4 books and his main interests are complex analysis and operator theory.

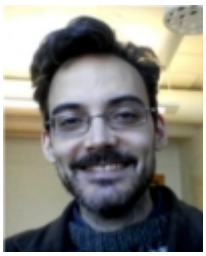
James A. Mingo - James A. Mingo was a student at Dalhousie University where he completed his PhD under the supervision of Peter Fillmore in 1982. He was a visiting assistant professor at Purdue University and UCLA, and a NSERC University Research Fellow at the University of Toronto. Since 1987 he has been at Queen's University and a professor there since 1997. He has served on various committees of the Canadian Mathematical Society including a term as Vice-President (Ontario) and Chair of the Finance Committee. His research interests concern operator algebras, free probability and random matrices. In particular the application of combinatorics to the study of the eigenvalue distribution of large random matrices.

Matthias Neufang - is a graduate of France's Université de Lille 1. He received a Mathematics PhD in 2000 from the UniversitÃ¤t des Saarlandes for his thesis entitled "Abstract Harmonic Analysis and Module Homomorphisms on von Neumann Algebras". He has taught at the University of Alberta and Carleton University. His principal work involves functional analysis and harmonic analysis, investigating the links between abstract harmonic analysis and Banach and operator algebra theory. He is the author of over fifty research papers and has organized numerous research conferences and special sessions. Neufang served as Interim Deputy Director of the Fields Institute from January to June 2009. He also served as Director of the Ottawa-Carleton Institute of Mathematics and Statistics, and Associate Dean of the Faculty of Graduate Studies and Research at Carleton University. His service to the profession include the positions of member of the Board of Directors of the Canadian Mathematical Society, as well as chair of the Natural Sciences and Engineering Research Council Pure Mathematics Grant Selection Committee.

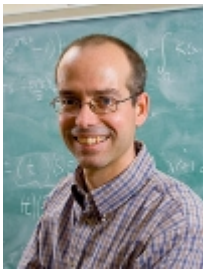
Michael A. Newton - Professor at the University of Wisconsin Madison, in the Departments of Statistics and of Biostatistics and Medical Informatics, where he has worked since completing his PhD in Statistics at the University of Washington in 1991. He earned his undergraduate degree in Mathematics and Statistics from Dalhousie University in 1986. Dr. Newton's research concerns the use of statistics in the biological sciences, especially inference problems in genomics and cancer biology. His service includes a term on the genome study section of the US National Institutes of Health, and a term as biological sciences editor of the Annals of Applied Statistics.

Mary Pugh - received a BA in pure mathematics from U.c. Berkeley in 1986, and MS and PhD degrees in mathematics from the University of chicago in 1988 and 1993, respectively. From 1993 to 1997, she was a post-doc at the Courant Institute and at the Institute for Advanced Study. From 1997 to 2001, she was an assistant professor at The University of Pennsylvania. Since 2001, she has been an associate professor at the University of Toronto. Her research is largely on the modeling, analysis, and simulation of thin films of viscous liquids, with a broader interest in computational methods for partial differential equations.

Peter Russell - Peter Russell obtained his PH.D from UC Berkeley in 1966 under the direction of Maxwell Rosenlicht. After spending three years as a Benjamin Pierce Instructor at Harvard University he joined the Department of Mathematics and Statistics of McGill University. He retired from McGill in 2009. He served as chair of his Department from 1988 to 1994 and as director of the Institut des Sciences Mathematiques in 1995/96 and from 2000 to 2004. He was Vice President for Quebec of the CMS from 1991 to 1993 and a member of the nominating committee from 1993 to 1995. His research is in algebraic geometry, in particular affine algebraic geometry, a sub discipline on the border of algebra, algebraic geometry and topology. He also has an abiding interest in positive characteristic geometry.



Hugh Thomas - University of New Brunswick. Associate Professor in the Department of Mathematics and Statistics at the University of New Brunswick. He received his Ph.D. in Mathematics from the University of Chicago in 2000. His research interests are in algebraic combinatorics, representation theory, and algebraic geometry. He presently serves on the board of the Canadian Mathematical Society.



James Watmough - received his Bachelor's degree in Engineering Physics in 1989 and his PhD in Applied Mathematics in 1997: both from the University of British Columbia. He held a postdoctoral position at Virgina Tech and a NSERC postdoctoral fellowship at the University of Victoria. He is currently a Professor (Mathematics) at the University of New Brunswick, Fredericton. Dr. Watmough's research interests are in mathematical biology: specifically epidemiology and ecology.

Juncheng Wei - Chair Professor at the Department of Mathematics, Chinese University of Hong Kong. He received his PhD from University of Minnesota in 1994. After one year postdoc at SISSA, he moved to Chinese University of Hong Kong. He was the recipient of Croucher Senior Fellowship (2005) and Morningside Silver Medal (2010). He is included in ISIHighlyCited (2010). His main research interests are Nonlinear Partial Differential Equations, Concentration Phenomena and Blow Ups, and Mathematical Biology.

Xingfu Zou - Professor of applied mathematics at the University of Western Ontario. He received his Ph. D from York University in 1997. Before joining UWO in January 2004, he pursued postdoctoral studies at the University of Victoria (Jan. 1997-July 1998) and Georgia Institute of Technology (July-Dec 1998), and was a faculty at Memorial University of Newfoundland (Jan 1999-Dec. 2005). His research interests are in applied dynamical systems including theories of ODEs, PDEs and FDEs and applications to various problems arising from biology and other fields.

AARMS Financial Statements

AARMS funds are held in accounts at Dalhousie University and The University of New Brunswick and are subject to the oversight and auditing of the Financial Services Departments of those universities. The following accounts are a view of the data compiled by Dalhousie and UNB.

The financial year is January 1 – December 31. The statements employ cash-flow accounting which is the method which records transactions when funds move, rather than when transactions are accrued. This is consistent with university statements but may create timing anomalies: if an event in 2012 is paid for in 2013 then it will show up in the 2013 accounts.

Income and Expenditure Account
2012

Income[1]	$	$	2011
Carried forward from previous year		80,268	79,861
Mathematical Institutes		90,000	90,000
Universities		97,000	95,000
Provinces		50,000	150,000
Other Revenue (1)		0	237
Total Income		**317,268**	**415,098**
Expenditure			
Summer School			
Instructors (2)	23,388		42,153.90
Students (3)	0		29,405.01
Other (4)	100		1,322.23
	23,488	**23,488**	72,881
Workshops and Events (5)		37,399	82,893
PDF Program (6)		100,000	107,322
Collaborative Research Groups (7)		24,000	24,000
Distinguished Lecturer Series		0	2,500
Book Series		0	0
Administrator Salary		28,823	28,761
AARMS Online system development		1,385	13,201
Travel		0	289
Office Expenses		1,204	1,639
Computer		0	1,230
Other		0	114
Total Expenditure		**216,298**	**334,830**
Surplus: Income Less Expenditure		**100,970**	**80,268**

Notes

1. For a breakdown see Appendix 1
2. Travel, Accommodation and stipends of $5,000 each
3. Residence and Meals
4. Texts and course materials, promotion, secretarial, computing , hospitality
5. See Appendix 2
6. See Appendix 3
7. See Appendix 4

Balance Sheet

31-12-2012

Assets	$	$
Surplus from Operations (Income less expenditure)		100,970
Accounts Receivable[1]		
CRM	45,000	
Fields	30,000	
PIMS	30,000	
Acadia	5,000	
Cape Breton	1,000	
Dalhousie	17,000	
Memorial	30,000	
Moncton	1,000	
Mount Allison	1,000	
Saint Francis Xavier	1,000	
Saint Mary's	1,000	
UNB	45,000	
UPEI	1,000	
Province of Nova Scotia	100,000	
Province of New Brunswick	50,000	
		358,000
Total Assets		**458,970**

Liabilities		
Accounts Payable[2]		
Summer School	122,000	
Postdoctoral Fellowships	135,000	
Scientific Activities[3]	77,636	
Collaborative Research Groups	60,000	
AARMS Book Series	1,000	
Administrator Salary[4]	28,761	
online development	1,000	
AARMS Poster	700	
Travel and Office expenses	3,000	
		429,097
Unallocated funds - for AARMS activities		29,873
Total Liabilities		**458,970**

Notes

1. Fees due to be collected in 2012
2. Funding Commitments in 2012
3. Workshops, Conferences, Meetings, Atlantic Algebra Centre

Annual Accounts 2012

Appendix 1

Revenue Breakdown

Provinces			
	New Brunswick	50,000	
	Nova Scotia	0	
			50,000
Mathematical Institutes			
	CRM	30,000	
	Fields	30,000	
	PIMS	30,000	
			90,000
Universities			
	Acadia	5,000	
	Cape Breton	1,000	
	Dalhousie	26,000	
	Memorial	30,000	
	Moncton	1,000	
	Mount Allison	1,000	
	Saint Francis Xavier	1,000	
	Saint Mary's	1,000	
	UNB	30,000	
	UPEI	1,000	
			97,000
Other Revenue			**0**
	total		**237,000**

Annual Accounts 2012

Appendix 2

Workshops and Scientific Events

Workshop on High Dimensional Data Analysis	2,947
CMS Winter meeting Poster Prize	1,000
MPE 2013 Virual Modules	500
SAGE Days at Acadia	2,888
Numerical Weather Models for Space Geodesy Positioning	1,964
NB Math Competition	1,900
Math Outreach in NB – John McLoughlin	4,000
CMS/UNB Math Camp	1,000
Workshop on Algorithms and Models for the Web Graph	2,000
PDF travel to the SIAM Discrete Mathematics Conference	4,000
CMS Summer meeting poster prize	1,000
Blundon Seminar	2,000
Workshop on Mathematical Biology	2,000
Cdn Conference on Computational Geometry	5,000
Cdn Undergraduate Math Conference	1,499
Dalhousie PDF promotional day	500
Summer School for Women in Math	1,201
SSC annual meeting	2,000
total	**37,399**

Annual Accounts 2012

Appendix 3

Postdoctoral Fellowships

Alexei Gordienko	17,500
Rui Peng	17,500
Dawood Kothawala	8,750
Hongying Shu	17,500
Maya Ghandehari	8,750
Peter Lumsdaine	8,750
Francis Valiquette	8,750
Charless Paquette	3,750
Rogers Mathew	8,750
total	**100,000**

Appendix 4

Collaborative Research Groups

Atlantic Algebra Centre	0
Dynamical Systems	12,000
Mathematical Ecology and Epidemiology	12,000
total	**24,000**