Atlantic Association for Research in the Mathematical Sciences

Annual Report 2023-24

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AARMS
Atlantic Association for Research in the Mathematical Sciences

2023/24 Annual Report

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1 Director's Message

The past year has been very active for Mathematical Sciences in Atlantic Canada. This annual report provides many details on the work in our community. Here are a few highlights.

In Summer 2023 we held the first in-person summer school since the start of the pandemic. The topic was Emerging Infectious Diseases Modelling and it was held at the Bonne Bay Marine Station in Newfoundland. Thirty-nine HQP participated in the two courses.

The collaborative research group (CRG) program continues to support very active groups to work across institutions, building collaborations and creating training opportunities. A description of their work is in section 3.1. In addition to many seminars and meetings, 35 HQP were partially supported by these projects.

AARMS provided partial support for eight post-doctoral fellows at UNB, Dal, and MUN. You can read more about these accomplished scholars in section 3.2.

Twenty in-person workshops and conferences, plus many more online meetings operated with AARMS support. Outreach continues to be an important part of our work, with several year-long and individual activities across Atlantic Canada (see section 3.5 for details).

All of the activities were led by the excellent network of researchers who create the programming that AARMS supports. I am grateful for their creativity and enthusiasm for this important work.

Many thanks are due to our outgoing Director Sanjeev Seahra. Sanjeev led AARMS with energy and initiative for eight years, overseeing many changes and supporting many new activities. Three highlights are

- launching a new travel award for junior researchers that supports conference and research travel for many students and post-doctoral fellows,
- securing a 5-year award from NSERC, providing stable funding for AARMS and enabling new programs, and
- navigating the many changes brought upon us by COVID with grace and efficiency.

Andrew Irwin
AARMS Director
October 2024

2 Report on Funding

The year was uneventful in terms of funding issues. We received the second installment of our 5-year NSERC Discovery Institutes Support Grant. We continue to receive support from AARMS Member Universities.

3 Report on Activities

3.1 AARMS Collaborative Research Groups (CRGs) Program

AARMS supported 3 Collaborative Research Groups in the 2023/24 academic year. Highlights from the reports from these groups are included below.

3.1.1 Advances in Statistical Modeling of Fisheries Data

3.1.1.1 Members

Academic Administrator: Asokan Mulayath Variyath, Memorial University

Researchers from AARMS Member Universities:

- Dr. Alwell Oyet, Memorial University
- Dr. Tariq Hasan, University of New Brunswick, Fredericton
- Dr. Gary Sneddon, Mount Saint Vincent University
- Dr. Zhaozhi Fan, Memorial University
- Dr. Nan Zhang, Memorial University
- Dr. Rafiqul Chowdhury, Cape Breton University
- Dr. Asokan Mulayath Variyath, Memorial University
- Dr Hamid Hatefi, Memorial University
- Dr Jahrul Alam, Memorial University
- Dr. Kunasekaran Nirmakanna, Memorial University
- Dr. Noel Cardigan, Marine Institute, Memorial University
- Dr. Hensely Hubert Mariathas, Centre for Rural Health Studies, Memorial University

Other CRG Members:

- Dr. Divya Varkey, Dept. of Fisheries and Ocean, St. John's, NL.
- Dr. Rajeev Kumar, Dept. of Fisheries and Ocean, St. John's, NL.
- Dr. Paul Regular, Dept. of Fisheries and Ocean, St. John's, NL.

- Dr. Cameron Ainsworth, College of Marine Science, University of Florida
- Dr. T.V. Sathianandan, Amrita Institute of Medical Sciences, Kochi, India
- Dr. Eldo Varghese, Central Marine Fisheries Research Institute, Kochi, India

3.1.1.2 Activities

Annual Meeting of CRG Members at Memorial University

The annual meeting of the CRG members (hybrid) was held on 28 August 2024 at Memorial University. More than 8 CRG members along with their students attended in person and several other members joined online. The morning session chaired by Dr. Zhaozhi Fan and following presentations were given:

- Longitudinal fish stock trajectory risk prediction using statistical and machine learning models/frameworks by Rafiqul Chowdhury
- Quantile regression analysis of a commercial fishing data by Hoaron Wang
- Parameter Estimation of Poisson Autoregressive Moving Average Model by Syeda Akter
- Fitting models for Age and weight of Atlantic fish data by Baiko Kevin

The afternoon session chaired by Dr. Noel Cadigan, mainly focused on the potential future research ideas.

Organization of SSC Annual Meeting Invited Session

An invited session was planned and organized to discuss the new research in the area of spatiotemporal models for complex fisheries data analysis at the annual meeting of the Statistical Society of Canada 2024. Title of the Session - Novel Spatiotemporal Models for Complex Data in Fisheries and Ecosystem Studies".

Seminar Series on Advances in Fisheries Data Analysis

A monthly series of seminars was organized online to disseminate the knowledge on various statistical analysis employed in fisheries data. A total of 10 seminars were conducted over the academic year 2023-24 and various topics were discussed. Attendance for these seminars were 20-30 participants. These seminars helped the CRG members on advances in statistical analysis in fisheries data and discussions on potential future research work.

Student Support:

Nine graduate students were supported partially to undertake research.

Scientific Outcomes:

During this period following publications are reported:

- Parameter Estimation of Poisson Autoregressive Moving Average Model by Syeda Akter SSC Annual Meeting 2-5 June 2024

- Shrinkage Estimators for Semi-parametric Proportional Hazards Mixture Cure Models – Poster presentation by Negar Kalanpour, SSC Annual Meeting 2-5 June 2024

Two Master of Applied Statistics reports were evaluated as part of the program. One graduate student has submitted the thesis and two other two graduate students involved in this project will submit their thesis during fall 2024. They are preparing manuscripts and will submit research articles to leading journals.

3.1.2 Applications of Commutative Algebra

3.1.2.1 Members

Academic Administrator: Sara Faridi (Dalhousie University)

Researchers from AARMS Member Universities:

- Sara Faridi, Dalhousie University
- Dharm Veer, Dalhousie University

Other CRG Members:

- Susan Cooper, University of Manitoba
- Adam Van Tuyl, McMaster University
- Thai Nguyen, McMaster University

3.1.2.2 Activities

The CRG started a virtual seminar “Combinatorial Commutative Algebra in Canada” which has been very well attended. This seminar fills a gap in our research field, since people who work in this area are scattered around the world, and there is no seminar series which is dedicated to the developments in this field. This well subscribed seminar featured the following talks during its first season.

- Anton Dochtermann, Texas State University. Title: Tropical Type Ideals with an Application to Toric Edge Rings of Bipartite Graphs
- Seyed Amin Seyed Fakhari, Universidad de los Andes. Title: Castelnuovo-Mumford Regularity of Symbolic Powers of Cover Ideals of Graphs
- Nursel Erey, Gebze Technical University. Title: Squarefree Powers of Edge Ideals
- Tai Ha, Tulane University. Title: Binomial Expansion for Rational Powers and Integral Closures of Sums of Ideals

The CRG organized the following conferences and schools.

- Diversity in the Mathematical Sciences, Organizers: Susan Cooper and Sara Faridi, Halifax, NS

- (WICA II) Women in Commutative Algebra II, CIRM, Trento, Italy,
- Special Session: Commutative Algebra, CMS Winter Meeting, Montreal,

Scientific Outcomes

- The weak Lefschetz property of whiskered graphs, Susan M. Cooper, Sara Faridi, Thiago Holleben, Lisa Nick-lasson, Adam Van Tuyl, Lefschetz Properties: Current and New Directions, Springer INdAM series (2024), 97-110.
- Simplicial resolutions of powers of square-free monomial ideals, Susan M. Cooper, Sabine El Khoury, Sara Faridi, Sarah Mayes-Tang, Susan Morey, Liana M. Sega, Sandra Spiroff, Algebraic Combinatorics, Volume 7 (2024) no. 1, pp. 77-107.
- Simplicial Resolutions of the Quadratic Power of Monomial Ideals, Susan M. Cooper, Sara Faridi, Hasan Mahmood, preprint (2024).
- Pseudo-manifolds arising from very well-covered graphs and grafted simplicial complexes, Susan M. Cooper, Sara Faridi, Thiago Holleben, Lisa Nicklasson, Adam Van Tuyl, in progress.
- The Roller Coaster theorem and unimodality statements in algebra, Susan M. Cooper, Sara Faridi, Thiago Holleben, Lisa Nicklasson, Adam Van Tuyl, in progress.
- D-Extremal ideals, Susan M. Cooper, Sabine El Khoury, Sara Faridi, Susan Morey, Liana M. Sega, Sandra Spiroff, in progress.

HQP supported

Five HQP received direct support from the CRG.

3.1.3 Games & Graph Searching in Atlantic Canada

3.1.3.1 Members

Academic Administrator: Danielle Cox, Mount Saint Vincent University

Collaborators from AARMS member universities:

- Danielle Cox, Mount Saint Vincent University
- Svenja Huntemann, Mount Saint Vincent University
- Shannon Fitzpatrick, University of Prince Edward Island
- Rebecca Milley, Memorial University
- Andrea Burgess, University of New Brunswick Saint John
- Nancy Clarke, Acadia University
- Danny Dyer, Memorial University
- Stephen Finbow, St. Francis Xavier University
- Jared Howell, Memorial University

- Margaret-Ellen Messinger, Mount Allison University
- Neil McKay, University of New Brunswick Saint John
- David Pike, Memorial University
- Iain Beaton, Acadia University
- Art Finbow, Saint Mary's University
- Richard Nowakowski, Dalhousie University
- Jeannette Janssen, Dalhousie University

Other CRG Members:

- Melissa Huggan, Vancouver Island University
- Gena Hahn, Université de Montréal
- Ben Seamone, Dawson College
- Pawel Pralat, Toronto Metropolitan University
- Karen Gunderson, University of Manitoba
- Gary MacGillivray, University of Victoria
- Kyle Burke, Florida Southern College
- Oznur Yasar Diner, Kadir Has University, Istanbul
- Jessica Enright, University of Glasgow
- Michael Fisher, West Chester University, Pennsylvania
- Bill Kinnersley, Rhode Island University
- Kerry Ojakian, The City University of New York
- Craig Tennenhouse, University of New England

3.1.3.2 Activities

Online Seminars

- Atlantic Graph Theory Seminar
  15 speakers ranging from undergraduate students to well-established researchers, national and international. Attendees were students and faculty from across Canada and beyond and were well attended.

- Virtual Combinatorial Games Seminar
  This monthly seminar featured seven main speakers, including undergraduate and graduate students, faculty members, and industry researchers, from Canada, the USA, and Europe. One additional event in that time period had several speakers give brief updates on current projects. A large portion of researchers in combinatorial game theory attend the seminar, with the majority from North America, but many also joining from Europe and Asia.

Winter GSAC research meeting
The 2024 Virtual GGSAC Winter Research Meeting was held online with a total of 42 registrants and four speakers: Dr. Kieka Mynhard (UVic), Dr. Anthony Bonato (TMU), Dr. Neil McKay (UNBSJ), and Dr. Craig Tennenhouse (University of New England). In the spirit of collaboration, these talks featured questions and open problems. We anticipate that the collaborations began at this workshop will result in future peer-reviewed publications.

GRASCan
The 2024 Graph Searching in Canada workshop took place at Dalhousie University. The plenary speakers were Dr. Kerry Ojakian (CUNY) and Dr. Andrea Burgess (UNBSJ). We had 31 attendees and 6 contributed talks, in addition to our two plenary speakers. The afternoons had time for collaborative work, and we anticipate that this meeting will result in future peer-reviewed publications.

Introduction to Research in Graph Searching Summer School
This one-day workshop was held at Dalhousie University, prior to the GRASCan workshop. In the morning Dr. Andrea Burgess ran a session called Introduction to Graph Theory and Dr. Kerry Ojakian ran a session called Introduction to Graph Searching. We had one postdoctoral fellow, 7 graduate students and 7 undergraduate students attend the workshop.

Summer Research Meeting
Members of the CRG met at Dalhousie University for a research meeting to work on new and current projects. We anticipate peer reviewed publications to result from this meeting.

East Coast Combinatorics Conference (ECCC) & Games Workshop
The 16th ECCC was held in-person at Grenfell Campus, Cornerbrook Newfoundland. There were 30 attendees from across Canada and beyond with 14 contributed talks (ranging from honours students to well established researchers) and two plenary speakers. After the event a three-day combinatorial game theory workshop took place which focussed on problem-solving.

Summer Student Research Seminar & Workshop
Four sessions were held. Summer research students explained their project and what they hope to accomplish, learned about new areas of research, learned presentation and public speaking skills and gave a final presentation on the results they achieved during their summer research Term.

Teaching Seminar
An in-person teaching workshop, The 4th Annual Calculus Instruction in Atlantic Canada workshop took place at Mount Saint Vincent University. We had 34 attendees. It is a workshop aimed at university and high school educators who teach upper level mathematics. As part of this

event the GGSAC ran a mini-workshop on introducing math research and focussed on problem solving. The attendees consisted of university instructors and high school educators. It was well received.

Outreach
A collaboration took place with NS Math Circles and a talk was given by some of our committee members. As well a workshop for junior high African Nova Scotian students took place at Mount Saint Vincent University; two schools brought classes to attend. Dr. Svenja Huntemann also gave a presentation for youth as part of the MSVU Science Circles program on combinatorial games.

Scientific Outcomes
The following is a list of collaborations that are currently taking place and the topics that are being investigated. We anticipate that publications will arise from each of these collaborations. In some cases, the papers are already under review.

- Deduction: Nancy Clarke, Andrea Burgess, Melissa Huggan, Shannon Fitzpatrick
- Graph Cooling: Nancy Clarke, Nimarjeet Bajwa, Iain Beaton, Erin Hughes
- Bodyguards and Presidents: Nancy Clarke, Danny Dyer, William Kellough
- Probabilistic Graph Burning: Nancy Clarke, Jeannette Janssen, Dylan Pearson
- Firefighting: Nancy Clarke, Andrea Burgess, Caleb Jones, William Kellough, Erin Meger.
- Graph Burning: Margaret-Ellen Messinger, Danielle Cox, Kerry Ojakian
- Cops and Attacking Robber: Margaret-Ellen Messinger, Melissa Huggan, Alex Chow
- A model for the competing spread of a virus with vaccines: Margaret-Ellen Messinger, Melissa Huggan, Dylan Pearson
- The immunization model: Margaret-Ellen Messinger, Nancy Clarke, Adrian Vetta, Ann Trenk,Karen Collins.
- Cops on Circulant Graphs: Danny Dyer, Shannon Fitzpatrick
- Slow Localization: Danielle Cox, Danny Dyer, Melissa Huggan
- Deduction (2 papers): Danny Dyer, Andrea Burgess, Boting Yang
- Deduction on Products: Danny Dyer, Andrea Burgess
- On the eviction model of eternal domination: Shannon Fitzpatrick, Stephen Finbow, Iain
- Beaton, Ben Seamone, accepted for publication 2024.
- An introduction to the deduction number: Andrea Burgess, Danny Dyer and M. Farahani submitted June 2024
- Deduction, Constrained Zero Forcing and Constrained Searching: Danny Dyer, Kerry Ojakian, Lusheng Wang, Mingyu Xiao, Boting Yang

HQP supported
Twenty-one HQP received direct support from the CRG.

3.2 AARMS Postdoctoral Fellowship Program

Each year AARMS conducts a competition to award Postdoctoral Fellowships to highly qualified personnel who received their PhD within the last 4 years. AARMS provides a portion of the funding for these positions, which must be at least matched by other research funding from the host university. The program is successful in attracting highly qualified young researchers to universities in New Brunswick and the rest of the Atlantic region. AARMS also makes available a travel grant of $1,500/year for each postdoc.

3.2.1 Postdoctoral Fellow Biographies

The following postdoctoral fellows have been supported by AARMS in the 2022/23 fiscal year:

Dipanjan Dey completed his Ph.D. in Physics at the Indian Institute of Technology, Kanpur, India in 2019 under the supervision of Professor Kaushik Bhattacharya. In his Ph.D., Dipanjan primarily investigated the gravitational collapse of compact objects in different cosmological scenarios. He then joined the International Center for Cosmology, CHARUSAT, India as a postdoctoral fellow under the supervision of Professor Pankaj S. Joshi. During his first postdoc, he was primarily interested in the causal structure of a singularity formed in a continual gravitational collapse of a compact object and the possible physical signatures of a non-spacelike singularity. In October 2022, Dipanjan joined Dalhousie university as an AARMS postdoctoral fellow under the supervision of Professor Alan A. Coley with the goal to investigate the causal structure of the singularity in a coordinate-independent way and to understand the spinor structure of the spacetime manifold of a collapsing compact object.

Alexandre Landry completed in 2020 at the Université de Montreal his PhD in theoretical physics under the supervision of Fayçal Hammad. The subject of the work was on the interaction of quantum particles with gravitation. In 2021, Alex continued to work with Fayçal Hammad. These early works make extensive use of Quantum Mechanics and General Relativity. As a Postdoctoral Fellow at Dalhousie University, Alex has been under the supervision of Alan A. Coley. Alex's main interests are alternative theories in gravity: Teleparallel Gravity and Teleparallel Geometry of Spacetimes. The goal is to explain the teleparallel structures of spacetime. Then, the goal is also to better explain the structures of universes by taking into account antisymmetric fields.

Luca Marchetti completed his cotutelle PhD at the University of Pisa and at LMU Munich in 2022. He worked as a postdoctoral fellow under the supervision of Daniele Oriti at LMU Munich, and joined the gravity group at the University of New Brunswick at the beginning of 2023. Luca's main research interest is the extraction of continuum physics from quantum gravity, focusing in particular on the emergence of cosmological and black hole spacetimes. He is also interested in renormalization and in the definition of physical notions of localization and evolution through the relational strategy, both issues being central to study and describe emergent continuum physics within quantum gravity.

Juan Margalef completed his Ph.D. in mathematical physics in 2018 under the supervision of Fernando Barbero and Eduardo Villaseñor. He did his first postdoc at Penn State University with Abhay Ashtekar. He became a postdoc at MUN with Ivan Booth and Hari Kunduri in 2022. His work revolves around the mathematical aspects of General Relativity and Field Theories. His main achievement is the development of the relative bicomplex framework, an essential generalization of the standard covariant phase space in the presence of boundaries, which has been used

by him and his collaborators to solve several long-lasting problems. His goal now is to apply these techniques to some horizons problems in which the group of MUN is a world-leading expert. Juan Margalef is also passionate about science communication and outreach.

Luuk Stehouwer completed his PhD at the Max Planck Institute for Mathematics in Bonn in 2024 under the supervision of Peter Teichner. His research is at the boundary between physics and mathematics, mostly in topological quantum field theory, algebraic topology, and higher category theory. His thesis work was about the application of dagger categories to unitary topological quantum field theory and contains a proof of the spin-statistics theorem. He also works on the mathematics of symmetry-protected topological phases of matter, using bordism groups and K-theory. For his AARMS postdoc at Dalhousie University, he has been mentored by Theo Johnson-Freyd.

Geoffrey Vooys completed his PhD at the University of Calgary in Summer 2021 specializing in arithmetic geometry and category theory. He has been working as a postdoctoral fellow under the supervision of Dorette Pronk at Dalhousie. Geoff's main research interests primarily include equivariant geometry, arithmetic geometry, (higher) category theory, descent theory, and applications of geometry and category theory to the Langlands Programme for p-adic groups.

Nomaan X completed his PhD at the Raman research institute in April 2021 working on various aspects of quantum field theory on causal sets. He joined the gravity group at the University of New Brunswick as a postdoctoral fellow. Nomaan's research interests include causal sets, discrete geometry and more broadly, computational methods in quantum gravity. He is also interested in classical and semi-classical general relativity.

Fanheng Xu, under the supervision of Sun Yuhua, received his PhD in pure mathematics from Nankai University in 2019. His doctoral dissertation is on Liouville-type Principles for Elliptic Equations and Inequalities on Riemannian Manifolds. He continued his academic research as a postdoctoral fellow at Sun Yat-Sen University from 2019 to 2022 after which he became an AARMS postdoctoral fellow at Memorial University of Newfoundland, working under the supervision of Prof. Xiao Jie. His main research interests focus on Applied Geometric Analysis and Partial Differential Equations.

3.2.2 Incoming Postdoctoral Fellows

We held our annual postdoctoral fellowship competition in the autumn of 2023. Four new postdoctoral fellows were appointed to start in the autumn of 2023: **Hansol Park**, who will work at Dalhousie under the supervision of Theo Kolokolnikov; and **Shanwei Ding**, who will work at Memorial University under the supervision of Deping Ye.

Postdoctoral fellowships which started in the autumn of 2023 were funded by AARMS at the level of $25,000/year. Matching funds were provided by their supervisor and host university. AARMS also makes available a travel fund of $1500/year for each postdoc. From September 2024, the AARMS allocation for a postdoctoral fellow goes up to $30,000/year.

3.3 AARMS Summer School

In the summer of 2023, for the first time since the Covid pandemic began, AARMS collaborated to run a summer school. The topic was **Emerging Infectious Diseases Modelling** and it was held at the Bonne Bay Marine Station in Newfoundland from August 19-31. Co-sponsors were:

- *Mathematics for Public Health*
- *The Canadian Network for Modelling Infectious Diseases*
- *The One Health Modelling Network for Emerging Infections*
- *Memorial University*
- The Canadian Centre for Disease Modelling.

photo contributed by Jessa Marley

AARMS EIDM Summer School

Guest lecturers

- Dr. Bouchra Nasri, Universite de Montreal
- Dr. Steve Walker, McMaster University
- Dr. Brenda Wilson, Memorial University
- Dr. Edward Thommes, Sanofi Pasteur

Courses

Two courses were presented, each consisting of 15 lectures, 2 guest lectures, problem solving challenges and a final project.

Course 1: Mathematical Epidemiology: This course covered different formulations and analyses of epidemiological models. Topics included host heterogeneity, multiple pathogens, spatial spread, within-host dynamics, and zoonotic spillover.

Course 2: Data, models, and decision support: Mathematical models provide decision support through forecasting, describing unrealized past outcomes (counterfactuals), and in communication. This course aimed to teach the technical skills to parameterize dynamical systems models in ecology and evolution, and quantify prediction uncertainty. The course examined case studies to understand the use of models in decision support.

Participants

There were 39 participants including undergraduates, Masters, Doctoral, Postdoc, and early career researchers. Eleven participants came from AARMS member universities and two were international. Three of the participants had attended an AARMS Summer School in the past facilitated by the relationship between AARMS and the African Institute for Mathematical Sciences (AIMS).

3.4 Workshops and Conferences

In 2023/24 in-person events had become common again. However, it appears that the use of videoconferencing technology has become a familiar and useful tool for many research groups who continued to make use of the AARMS ZOOM license for seminars, meetings and other distributed interactions. The list of events for the year is given below.

Integration Tournament for UPEI students
University of Prince Edward Island
March 14, 2024

Atlantic Graph Theory Seminar
Online via Zoom
March 6, 2024 @ 3:30 pm - 4:30 pm

2024 Integration Competition
Saint Francis Xavier University
February 29, 2024

Atlantic Graph Theory Seminar
Online via Zoom
February 28, 2024 @ 3:30 pm - 4:30 pm

Girls STEM Up
Delta Hotels by Mariott, Fredericton
February 24, 2024

AARMS Seminar: EDI in STEM with Dr. Lisa Willis
February 22, 2024 @ 2:00 pm - 5:00 pm

Atlantic Graph Theory Seminar
Online via Zoom
February 21, 2024 @ 3:30 pm - 4:30 pm

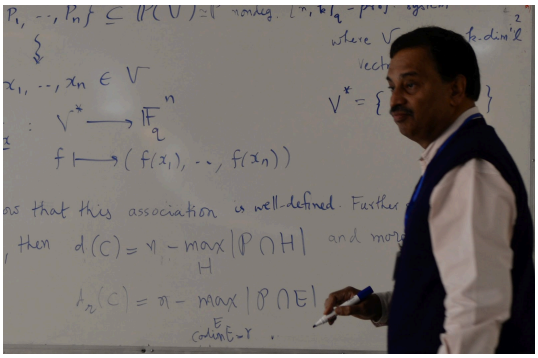
Combinatorial Algebra Meets Algebraic Combinatorics

Atlantic Graph Theory Seminar
Online via Zoom
February 14, 2024 @ 3:30 pm - 4:30 pm

Atlantic Graph Theory Seminar
Online via Zoom
February 6, 2024 @ 3:30 pm - 4:30 pm

Atlantic Graph Theory Seminar
Online via Zoom
January 31, 2024 @ 3:30 pm - 4:30 pm

Combinatorial Algebra Meets Algebraic Combinatorics
Montreal
January 26, 2024 - January 28, 2024



19th Seminar on Commutative Algebra and Related Topics

Atlantic Graph Theory Seminar
Online via Zoom
January 24, 2024 @ 3:30 pm - 4:30 pm

Atlantic Graph Theory Seminar
Online via Zoom
January 17, 2024 @ 3:30 pm - 4:30 pm

Advances in Statistical Modeling of Fisheries Data – Seminar
online via webex
December 1, 2023 @ 2:00 pm - 3:00 pm

Applied Category Theory Conference

Session on Combinatorial Design Theory at the 2023 Winter Meeting of the Canadian Mathematical Society
Montreal
December 1, 2023 - December 4, 2023

Atlantic Graph Theory Seminar
Online via Zoom
November 29, 2023 @ 3:30 pm - 4:30 pm

University of New Brunswick Data Challenge 2023
University of New Brunswick (Fredericton Campus)
November 24, 2023

Atlantic Graph Theory Seminar
Online via Zoom
November 22, 2023 @ 3:30 pm - 4:30 pm

Atlantic Graph Theory Seminar
Online via Zoom
November 1, 2023 @ 3:30 pm - 4:30 pm

Atlantic Graph Theory Seminar
Online via Zoom
October 18, 2023 @ 3:30 pm - 4:30 pm

Women in Commutative Algebra II
Trento, Italy
October 16, 2023 - October 20, 2023

2023 Science Atlantic MSCS Conference
University of Prince Edward Island
October 13, 2023 - October 15, 2023

Atlantic Graph Theory Seminar
Online via Zoom
October 4, 2023 @ 3:30 pm - 4:30 pm

Atlantic Graph Theory Seminar
Online via Zoom
September 20, 2023 @ 3:30 pm - 4:30 pm

Cdn Discrete and Algorithmic Mathematics Conference

Groups, Rings, Lie and Hopf Algebras. Fifth Edition
Memorial University (Harlow Campus)
August 21, 2023 - August 27, 2023

2nd workshop of AARMS CRG on Mathematical Foundations of Scientific Machine Learning
University of New Brunswick (Fredericton Campus)
July 31, 2023 - August 1, 2023

Topological Quantum Theory Spring School

6th International Conference on Applied Category Theory
University of Maryland
July 31, 2023 - August 4, 2023

Bridges Math and Art Family Day
Halifax Central Library
July 30, 2023 @ 1:00 pm - 5:30 pm

Public Lecture: The hat, the turtle and the spectre
Dalhousie University
July 27, 2023 @ 8:00 pm - 9:30 pm

Bridges Halifax 2023
Dalhousie University
July 27, 2023 - July 31, 2023

29th Workshop on Logic, Language, Information and Computation
Dalhousie University
July 11, 2023 - July 14, 2023

Theory Canada 15

Theory Canada 15
Mount Allison University
June 16, 2023 - June 18, 2023

Canadian Discrete and Algorithmic Mathematics conference
Winnipeg, Manitoba
June 5, 2023 - June 8, 2023

East Coast Combinatorics Conference 2023
Acadia University
May 10, 2023 - May 11, 2023

Topological Quantum Field Theory Spring School
Old Orchard Inn and Conference Centre
May 1, 2023 - May 5, 2023

3.5 Outreach

3.5.1 Ongoing Activities

In 2023/24 AARMS sponsored a number of activities which involved extended relationships between mathematicians and their communities over a pattern of multiple interactions. These are listed below.

Connecting Math to Our Lives and Communities.
Show Me Your Math: Connecting Math to Our Lives and Communities (CMTOLC) is a focused in-community mathematics outreach program serving Mi'kmaw and African Nova Scotian youth in Eastern Nova Scotia. AARMS funding supported the continuation of this successful and

requested program and also allowed for the enhancement of a new summer camp. CMTOLC is run in partnership with local Mi'kmaw and African Nova Scotian communities to engage youth in meaningful, relevant, hands-on investigations of mathematics. Twenty-one undergraduate and Bachelor of Education students were employed as community outreach facilitators, three of whom served as outreach leaders who provided peer mentorship in addition to their facilitation roles. Topics for programming were derived from student interest and community input, and included natural disaster preparation and response in the wake of the impact of Hurricane Fiona which explored wind speeds and geometry in structural integrity, the mathematics of deforestation, water security particularly in historically marginalized communities in Canada, patterns and knots in crafting and hunting, angles in sports, and understanding large quantities through space connected to cultural star stories.

Connecting Math Outreach

AV Middle School Outreach

This program consisted of monthly visits to 2 local schools in the Annapolis Valley: Evangeline Middle School and Wolfville School. In total there were 6 1-hour sessions with 9 - 21 participants for each session. At each of the schools 1 Acadia faculty member began the program with the assistance of 3 Acadia University student helpers. After sufficient training, the 3 Acadia student helpers either led or co-led subsequent sessions.

Dalhousie Math Challenge Club

The Dalhousie Math Challenge Club is a weekly after school activity which has two levels: the junior club for grades 5-7 and the senior club for older children. The club is led by Dr Dorette Pronk from Dalhousie University and facilitated by a group of enthusiastic undergraduate and graduate students. It engages in fun and challenging math problems and participates in competitions offered by the Canadian Math Society and also some international competitions. The club seeks to foster community among the students, help students learn to solve problems together and also help those who are interested in competing internationally in training to solve Olympiad-level problems.

Mathematical Outreach in New Brunswick

This program, led by Dr. John Grant McLoughlin, takes place in schools and community settings across New Brunswick. Particular focus is given to outreach in First Nation schools and rural communities. The initiative extended to approximately 25 schools over the course of the 2023-24 academic year. An effort is made to bring mathematical games, ideas, and activities to elementary, middle and secondary school classrooms. Special events such as a mathematical

day, recreational math exhibits (e.g. at STEAM Expo), and sharing of games in community settings such as libraries will figure into the outreach plans.

3.5.2 Outreach Events

In 2023/24 AARMS also sponsored a number of discrete outreach events:

Girls STEM Up
Fredericton
Feb 24, 2024

UNB Data Challenge
University of New Brunswick
November 2023

Acadia Math Buffet
Acadia University
September, 2023

Acadia Junior Math and CS Camp
Acadia University
July, 2023

Black Educators Assn. / Dalhousie Math Camp
Dalhousie University
July 2023

UNB Math Camp
University of New Brunswick
May 2023

Girls STEM Up

BEA/Dal Math Camp

3.6 Scholarships and Awards

3.6.1 Graduate Student Scholarship

These scholarships aim to provide extra incentive to attract excellent students to Atlantic Canada, and will contribute to a healthy exchange of students and ideas between universities across Canada. In 2024 we awarded two prizes of $5,000 each to:

William Kellough, is a second year master's student at Memorial University supervised by Danny Dyer and Nancy Clarke (Acadia University). William began his studies at the University of Manitoba where he obtained a joint honours degree in mathematics and statistics. He conducts research in graph theory and studies pursuit-evasion models in graphs. These models can be thought of as two-player games where one player controls a group of pursuers while a second player controls an evader. The goal of the pursuers is to move to the location of the evader while the evader's goal is to indefinitely avoid the pursuers. The main application for this research is in robotics where the algorithms used to solve these games can be translated into algorithms that robots can use in various emergency scenarios.

Serhii Koval, Ph.D. student at Memorial University of Newfoundland. After enrolling in the M.Sc. program at MUN in 2021, he also became a member of two research groups: one led by Dr. Alex Bihlo at MUN and another led by Prof. Roman O. Popovych at Kyiv Institute of Mathematics. His research interests focus mostly on algebraic and geometric methods in mathematical physics and symmetries of differential equations, Lie groups and Lie algebras. He is also interested in pure and applied algebra, in particular, the representation theory of groups and algebras, deformations of algebras and algebraic geometry. Moreover, he is actively contributing to the academic community by reviewing research papers for prestigious journals in mathematics and theoretical physics.

3.6.2 Doctoral Thesis Award

The Doctoral Thesis Award was not awarded in 2023/24, due to a low number of applications. In the next year the eligibility rules will be widened to encourage more nominations.

3.7 Junior Researcher Travel Support

In 2023/24 we continued the Junior Researcher Travel Support Program with a budget of $20,000 to support graduate students and postdocs traveling to attend national and international conferences and workshops. The program has been well subscribed, helping HQP meet peers and find opportunities for collaboration and professional networking.

3.8 Equity, Diversity and Inclusion

AARMS aims to promote and celebrate diversity in the broadest sense, supporting a community that is welcoming and engaging for persons from a wide range of personal and professional backgrounds. These are essential elements for achieving excellence in mathematical sciences research and dissemination.

Furthermore, we are committed to positively encouraging and supporting the participation of persons from underrepresented groups including, but not limited to, indigeneity, race, nationality, ethnicity, gender identity, sexual orientation, ability, neurodiversity, socio-economic status, and religion, in all aspects of AARMS activities.

An EDI committee meets throughout the year to provide diverse input, criticism and fresh ideas into the achievement of these goals. AARMS is also collecting statistics on the representation of underrepresented groups in the AARMS community. These statistics are displayed on our website at https://aarms.math.ca/about/edi/ .

4 Governance and Administration

In 2023/24 the AARMS Board appointed a Search Committee to find candidates and assess their suitability for the position of AARMS Director, as the term of Director Sanjeev Seahra was coming to an end. The Search Committee recommended Dr. Andrew Irwin of Dalhousie University, which was approved by the Board in the spring Board meeting.

5 Accounts

See the following page.

Income and Expenditure Account
April 1, 2023 - March 31, 2024

Income		2022-2023
Carried forward from previous year	151,815	170,264
Previous commitments written off	0	23,753
NSERC DIS	372,819	372,819
Universities	77,000	65,500
Provinces	0	0
NSERC other grants	0	30,000
Other Revenue	10,180	167
	459,999	
Total Income	**611,814**	**662,503**

Expenditure		
Summer School	44,664	0
Workshops and Events	59,401	28,528
General Scientific Activity	7,000	0
Outreach	24,457	10,501
PDF Program	171,010	223,050
Collaborative Research Groups	100,000	167,500
IPSW	0	0
Graduate Scholarships	10,000	10,000
Doctoral Thesis Award	0	5,000
Jr. Researcher Travel	21,190	662
Administration, travel and overheads	61,752	65,447
Total Expenditure	**499,474**	**510,688**
Surplus:	**112,340**	**151,815**