



Newsletter

Autumn 2016

Call for Proposals: Collaborative Research Groups

A Collaborative Research Group (CRG) typically consists 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.

Eligibility

AARMS will accept submissions from groups of 3 or more Atlantic Provinces University researchers who demonstrate that they have common research interests and wish to collaboratively develop some aspects of their research programs. They should also demonstrate an intention to develop a viable group in the long term, preferably with national and international connections and collaboration.

Activities funded

An AARMS CRG grant will specifically contribute funding toward activities that enhance the collaborative aspect of the CRG, including but not limited to:

- Joint seminars and guest lectures.
- Travel associated with joint supervision of students and pdfs
- Graduate student support
- Undergraduate research projects
- Student exchanges
- Travel to group events

Funding can only be applied to areas which are not covered by

other existing AARMS programs. For example CRG funds cannot be used as matching funds for an AARMS postdoctoral fellowship or to fund a workshop which would be eligible for funding under the AARMS workshops and conferences program. If you are uncertain about the eligibility of certain activities please contact us. CRG funds may not ordinarily be used to pay an honorarium to a visiting lecturer. If compelling reasons exist for paying an honorarium, the CRG may approach the Executive for permission. A request for permission must take place before any arrangements are made.

AARMS will award successful groups a yearly amount up to \$20,000/year for two years. The amount depends on need and the availability of funds. Once awarded, the amount will not be changed for the duration of the CRG. Funding for the second year is conditional on a successful first year. Funded groups may reapply to the program. In this round we expect that, at most, 2 groups will be funded. In addition, CRGs will have favourable status for applications under the other AARMS programs during their tenure.

Administrative structure

A CRG must name a Group Administrator who will be responsible for all communication with AARMS and who will, if funding is approved, administer the group's accounts and prepare progress reports for AARMS. An AARMS CRG is expected to maintain a website with a list of current members, group publications and past and upcoming events.

Application

Applications are expected to show evidence of research strength in the members, and a convincing plan for collaboration. A history of collaboration is taken to be a good indication of future collaborative success. Concrete plans for coordination with other AARMS programs (proposal for a relevant summer school topic, relevant workshops, a joint PDF application, etc.) will be viewed favourably. Applications will also be favoured that demonstrate a reach beyond the Atlantic Region. And, all other aspects being equal, preference will be given to new applications over requests from current CRGs for a renewal of funding.

For information on how to apply visit
<https://aarms.math.ca/crg-program/>

News

2016 Atlantic Universities Mathematics, Statistics and Computer Science Conf.

The 2016 Atlantic Universities Mathematics, Statistics and Computer Science Conference was held at Cape Breton University from October 14-16. On the afternoon of the 14th the Science Atlantic Math/Stats committee and the Computer Science committees met, and the ACM programming competition and the Mathematics competition were held. The Blundon lecture on Friday evening was given by Dr. Kabe Moen from the University of Alabama whose talk title was "Hearing the shape of a drum". After that the traditional wine and reception took place. About 150 people attended the conference, including nearly 100 undergraduate students.

On Saturday Morning, the first activity was a NSERC Scholarship Presentation by Dorette Pronk (Dalhousie) followed by undergraduate mathematics and computer science student presentations. Then two special presentations were given by Dr. Daniel Silver from Acadia University (CS) and Dr. Shannon Ezzat from University of Winnipeg (Math) in parallel. After a nutrition break, the Sedgwick Lecture was given by Dr. Anne Condon from the University of British Columbia whose title was "Models and hardness results for predicting secondary structure and kinetics of interacting DNA strands". Then, more undergraduate math and CS student presentations were held.

Saturday afternoon began with mixed graduate and math undergraduate student presentations. Following the afternoon nutrition break, the Field Lecture in Statistics was given by Hugh Chipman of Acadia University whose title was "An Overview of Statistical Learning". After that the ACENET session and the final undergraduate mathematics student presentations were held.

The banquet took place on Saturday evening. The room was crowded, but there was space for everyone and the food was good too. There were plenty of opportunities for renewing old acquaintances and making new ones. Following the meal, announcements were made and certificates were issued to all prize winners (see below for details). Finally, the Science Atlantic representative, Jasmine Golf, presented a plaque to Dr. Robert Dawson for being inducted into the Science Atlantic Hall of Fame as an Outstanding Member for 2016. She also awarded 13 faculty who had served as Science Atlantic committee members for more than ten years with a commemorative pin.

On Sunday morning, an Atlantic Association for Research in the Mathematical Sciences session was held. The Title was "Partial Differential Equations: Regularity, Numerics, and Applications". There were 7 presentations (5 professors, 2 Ph. D students and 1 researcher) with nearly 20 researchers in attendance.

ACM Intercollegiate Programming Competition

There were 16 teams of three students who participated in the Programming Competition. First place: Vlad Marics, Lucas

Pond, Caleb Reath (UNB Fredricton); Second place: William Fiset, Thomas Lidbetter, Micah Stairs (MTA); Third place: Sam Doiron, Orjan Monsen, Mitchell Zinck (Dalhousie)

Mathematics Problem Solving Competition

There were 19 teams of students who wrote the Problem Solving Competition. Most were pairs of students who wrote the test in English but one team used the French version and another contained three singleton students from different universities). First place: Leah Genge and Noah MacAulay (MUN); Second place: Shael Brown and Jordan Barrett (Dalhousie); Third place: Anton Afanassiev and Kaveh Mozafari (MUN).

Student Research and Communication Presentations

There were four undergraduate computer science student presentations, eleven undergraduate mathematics student presentations, four graduate student presentations (one joined in ACENET session), three ACENET student presentations in the student research sessions. Only one statistics student gave a talk and that was in the ACENET session.

Best Oral Presentation (Computer Science). 1st place: Martin Main, (Acadia); 2nd place: Sarah Thompson (UPEI).

Best Oral Presentation (Mathematics). 1st place: Jordan Barrett (Dalhousie); 2nd place: Katie MacEachern (SFXU); 3rd place: Leah Genge (MUN).

Science Atlantic Communication Award. Undergraduate: Joshua Feldman (Dalhousie); Graduate: Milton King, (UNB Fredericton).

ACEmat Award in Computational Modeling of Materials. 1st place: Sarah Walsh (CBU).

Science Atlantic issued \$1,825 cash prizes to all winners with \$100 for first place, \$75 for second place and \$50 for the third place. We would like to thank our main sponsors: AARMS, Science Atlantic, ACENET, Cape Breton University, and ICPC.

- George Chen, CBU, Conference Organizer



News

An AARMS Postdoc reports: Nathan Grieve

I studied in Kingston (Ontario) and am currently an AARMS postdoctoral fellow (2015-2017) at the University of New Brunswick under the supervision of Colin Ingalls. I was born in Vancouver, raised in Saskatchewan (Swift Current and Regina), and before coming to Fredericton, I was a postdoctoral fellow at McGill University (2013-2015).



My broad research interests include Geometry, Algebra and Number theory.

My research involves algebraic curves, Abelian varieties, vector bundles, linear series on projective varieties, rational points and function fields. These important areas of algebraic, complex, arithmetic and differential geometry also interact fruitfully with combinatorics, discrete mathematics, representation theory, mathematical physics, topology and computer algebra. As a consequence, I also find these subjects interesting.

One aspect of my current research involves the study of rational points of projective varieties. For example, in a recent preprint, I study the complexity of approximating rational points of a projective variety defined over a function field of characteristic zero. I first extend a form of the Subspace Theorem and then use this result, which is also of independent interest, to show how it can be used to prove Roth-type theorems, by analogy with those formulated in the number field setting by McKinnon-Roth. One of the main goals, in this direction, is to obtain lower bounds, expressed in terms of local measures of positivity, for approximation constants of rational points. These results are achieved by first giving sufficient conditions for approximation constants to be computed on a proper subvariety. As it turns out, as emphasized in the work of McKinnon-Roth, these kinds of theorems are related to rational curves lying in projective varieties.

Another aspect of my current research involves the geometry and arithmetic related to central simple algebras. For instance, in a recent joint preprint with Colin Ingalls, we study the birational geometry of orders lying in central simple algebras over characteristic zero function fields of normal projective varieties and their relation to Brauer groups. As one source of motivation for what we do is work of Chan-Ingalls where the authors consider Brauer classes arising from function fields of algebraic surfaces. By contrast, in our joint work, we consider Brauer classes arising from function fields of arbitrary transcendence degree. We first use structure theory, pertaining to hereditary orders over complete discrete valuation rings, to

define ramification divisors for a given Brauer class. Using this definition, we define log pairs and a notion of Iitaka-Kodaira dimension for such classes. Our main results concern the nature of these concepts under various natural geometric constructions.

As an AARMS postdoctoral fellow I have presented my work and participated in several workshops both within Canada and the northeastern United States. I also enjoy teaching mathematics and while at the University of New Brunswick I have contributed to the undergraduate program by teaching core introductory courses to Science and Engineering students.

Finally, as an AARMS postdoctoral fellow, I have enjoyed the distinct geographical features that New Brunswick has to offer. Indeed, exploring the Saint John River Valley and the Fundy Coastline for example, has been one of many pleasant aspects to conducting Mathematics research in Fredericton.

ICA Awards Medals Retroactively

I am happy to report that ICA is (slowly) getting back to track. One of the top priorities of the Council has been to re-establish the medals awarding process.

No medals have been awarded since 2009, hence the first step was to award medals for 2009 and 2010. For these two years, only nominations submitted originally during these two years were considered. No nominations for 2009 were made, and those for 2010 were evaluated by the ICA Medals Committee, Charlie Colbourn (chair), Jonathan Jedwab, and Christine O'Keefe. Following the committee's recommendation, the Council voted and decided to award the following medals: Euler medal: Prof. Bojan Mohar. Hall medal: Dr. Catherine Greenhill. Kirkman medal: Dr. Daniel Horsley and Dr. Kai-Uwe Schmidt

All four citations are in the attachment. Sincere congratulations to all winners! I would also like to remind you that the nominations for years 2011-2013 are due October 1st.

Moreover, the BICA Committee (Dalibor Froncek, chair, Spyros Magliveras, Jeff Dinitz, Bill Kocay) recommended and Council approved the following motions:

Motion 1: Due to EIC resignation and a need to fill the Editorial Board, BICA Committee will solicit nominations and self-nominations for EIC and Editorial Board members from the Council.

Motion 2: Once elected, the new EIC and EB will investigate and recommend to Council the steps necessary for online publication of BICA. The online version shall be free for ICA members and available for a fee to general public. The printed version will be still published.

Motion 3: BICA editorial and publishing office will be moved from its current location to an institution which will be determined and approved by the Council later.

Currently, BICA Committee is reviewing the nominations for EIC and EB. We hope to appoint a new EIC very soon, and then the committee along with the new EIC will continue working on the EB selection.

- For ICA Council: Dalibor Froncek

Report on the 2016 Summer School

The theme of the 2016 AARMS Summer School was “Applications of Category Theory, Combinatorics and Number Theory”. It featured two courses in category theory: Higher Category Theory and Categorical Logic, taught by Peter Lumsdaine (Stockholm University) and Michael Shulman (University of San Diego), and Quantum Computation and Topology, taught by Jamie Vicary (University of Oxford). The other two courses were Stable polynomials: with applications to graphs, matrices, and probability, taught by David Wagner (University of Waterloo), and An Introduction to Special Functions and WZ Theory, taught by Armin Straub (University of South Alabama). The directors of the school were Dorette Pronk (Dalhousie University) and Geoffrey Cruttwell (Mount Alison University).

Before the official start date of the school Geoffrey Cruttwell taught a week of preparatory lectures in category theory to prepare students for the category theory courses in the summer school. These lectures were attended by about 15 participants, some of whom were postdocs and some of whom were not taking the category theory courses, but were interested in getting an introduction to category theory. This may be something that future summer school directors may want to take into account. Some students like to get an introduction into subjects in which they have not been able to take a course thus far.

The school itself was attended by forty-three students and four postdocs. Twelve of the students and one of the postdocs were from Halifax and we had one other student from elsewhere in Atlantic Canada (UPEI). This was our first year to sponsor students affiliated with AIMS (the African Institute for the Mathematical Sciences). We were able to fund two students; one female student from Ghana who took the category theory courses and one male student from Ethiopia who took the number theory and combinatorics courses. We ended up enrolling three students from Africa, because the third one, a female student, was already in Canada to work with Dr David Kribs at the University of Guelph. Our other students came from other Canadian provinces, the United States, Australia and various European countries.

Aside from daily lectures in the four subjects, the courses in quantum computing and number theory featured computer labs and the two category theory courses included tutorials, which were taught by TAs. All courses were evaluated through a set of assignments and a final examination.

The courses generated a fair amount of activity in the department: local researchers and students joined the lectures and discussion groups formed of students and faculty. The students would work on assignments in groups during the afternoons or meet one on one with instructor, and could be found in various locations in both the math and physics departments. (We used the classroom space in the physics department for the lectures, labs and tutorials.) The course instructors in category theory also took advantage of this time to do research together and to work with some of our local faculty on new research projects.



Dalhousie has converted several older homes into mini-residences and we used three of these buildings to house the students and some of the postdocs for the summer school. Some of the instructors and the remaining postdocs stayed in our newest residence, Le Marchant Place, and other instructors stayed at the Lord Nelson Hotel or had made local airbnb arrangements.

Although we encountered some problems with the kitchen facilities in the mini-rez houses during the first days of the school, the students really appreciated the sense of community that living in the mini-rez houses provided them with. Some of them stayed in the newer residences for their last few nights, and they indicated that the mini-rez living had been much more enjoyable and had given them the opportunity to get to know their classmates much better. Access to Dalplex was also much appreciated and we were pleased to receive a request for more table tennis balls.

Generally, the workload for the students was rather high and their own social activities were organized based on when assignments were due. However, most of them did not let the large workload hold them back from exploring the new country they were visiting. We organized two excursions on the weekends: one to Cape Blomidon with Hall's Harbour and one to the South Shore (Blue Rocks, Lunenburg, Risser's Beach and Peggy's Cove). Both excursions were well attended and enjoyed by all who came along. The students talked one of our local graduate students, Darien DeWolf, into taking them on an additional hike to Cape Split and Darien used the fourth weekend to organize a workshop where most of the students gave a talk about their own research. This was quite interesting and encouraging to the students. We would recommend this for future summer schools as well.

The category theory community took advantage of the summer school and organized the annual category theory conference during the week following the summer school. It was good to see that most of the students stayed for the additional week of the conference, and a large number of them presented their work during the meeting as well. We were impressed with the level of the work they had done and were pleased to see the variety in their work. (They would normally not all have been at the meeting, due to the travel expenses.) However, this also shows that the background of the students in the school varied widely. For some of the students attending the school this was just their second category theory course (or the first one after some preliminary reading) and others had already been

extensively involved in research. Since the courses were fairly demanding and doing a grad course in four weeks is challenging to start with, we decided to give students the option of receiving a certificate of participation rather than a grade if that grade would not have been to their normal standards.

Our final activity, after all exams were written, was a farewell lobster supper at the Saint Mary's Boat Club. We were grateful to receive the help from Christopher Duffy, the AARMS Outreach Postdoc, and Evangelia Aleiferi, one of our local graduate students, in organizing this. They did an excellent job and it was fun to introduce the students to another wonderful Maritime tradition. We hope to see most of these students back at future conferences and workshops and hope that they will want to come back to do research here in Atlantic Canada.

- Dorette Pronk



Donald Violette wins Pouliot Award

It was recently announced that Dr. Donald Violette has won the Adrien Pouliot Award, presented at the 2016 CMS Winter Meeting in Niagara Falls.

Dr. Violette is a Professor of Mathematics in the Department of Mathematics at the University of Moncton and began his teaching career there in 1977, prior to obtaining his Ph.D. in 1984. He was the first francophone from New Brunswick to obtain a doctoral degree in mathematics.

His students describe him as a very passionate teacher who has their success at heart. He has received many accolades for his teaching, such as the first University of Moncton Excellence in Teaching award and seven awards of excellence in Maclean's magazine Canadian University Guide. Besides being highly respected by his undergraduate students, Dr. Violette is active in outreach and has given more than 300 presentations to over 11,000 students across New Brunswick.

Please join us in congratulating Dr. Violette for receiving this well-deserved award!

Games@Dal 2016

The event was held August 10-13, 2016, organized by Melissa Huggan, Svenja Huntemann, Urban Larsson and Richard Nowakowski. Talks were presented on the first day. The other days were spent in groups working on problems. Fifteen people, including four students, from North America and Portugal attended the Talks and Workshops. Another six people from Dalhousie attended the talks or parts of the Workshops.

For the Workshops, several problems were identified in advance and the participants divided into groups and worked on these problems. Participants were free, and encouraged to wander between groups. Before lunch and at the end of the day, the progress on each problem was discussed.

August 10: Talks:

- Neil McKay: Hereditary Transitive Games.
- Craig Tennenhouse: PenFib Nim, a new conjoined game
- Carlos Santos with Richard Nowakowski & Alexandre Silva: 3-Player NIM with «Podium Rule»
- Israel Rocha with Urban Larsson: Eternal Picaria:
- Alda Carvalho with Carlos Santos: Some Notes on Disjunctive Short Sum
- Urban Larsson: Hopeful windows and fractals in cellular automata and combinatorial games
- Tanya Konohava: Cookie Monster Game

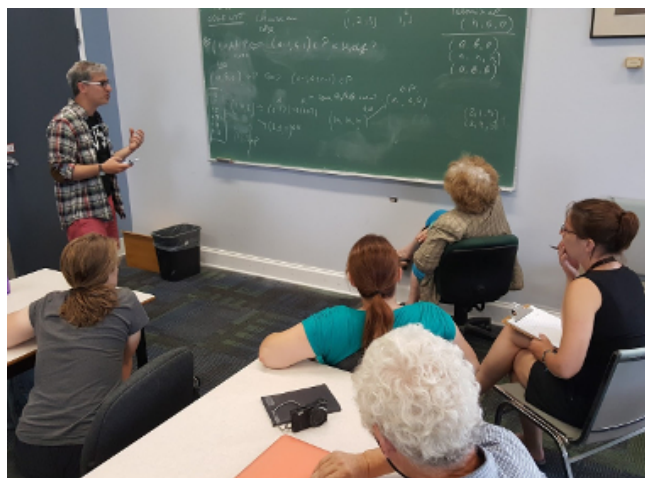
Workshop Problems:

- (1) Edge Wythoff;
- (2) Split-Ends Nim;
- (3) Take-Small;
- (4) Hiding the Truth;
- (5) Short Disjunctive Sums.

From these discussions, four papers are in preparation:

- (1) M. Fisher, M. Huggan, S. Huntemann, Split-Ends Nim;
- (2) T. Khovanova, R. Nowakowski, Nim on Ideals;
- (3) A. Carvalho, N. McKay, R. Nowakowski, C. Santos, Short Disjunctive Sum: a new approach.
- (4) K. Burke, T. Khovanova, R. Nowakowski, A. Rowland, C. Tennenhouse: Hiding counterfeit coins.

- Richard J. Nowakowski



An AARMS Postdoc Reports: Aras Erzurumluoglu

My first participation in an AARMS-sponsored event (and the first time I travelled to Canada) dates back to 2012. At that time I was a first year doctoral student at Auburn University. One day I replied to an email that was forwarded to me and then in the following summer I found myself at the AARMS summer school held in St. John's at Memorial University of Newfoundland, that was organized by Mihail Kotchetov and David Pike. From mid-July to mid-August in 2012 I took a course on combinatorial designs and graph decomposition taught by Darryn Bryant, and another course on the probabilistic method and random graphs taught by Pawel Pralat while also enjoying the social events and forming long-lasting friendships with other participants of the summer school. Having had an overall great experience with the summer school, since then I had been wanting to come back to Atlantic Canada, in particular to Newfoundland, to continue my research. This wish came true when, after the completion of my doctoral degree in 2015, I was offered a postdoctoral fellowship to work at Memorial University of Newfoundland with David Pike on problems in combinatorial design theory and graph theory. Several months later we have been given the chance to extend this collaboration through an AARMS postdoctoral fellowship.



During my time as an AARMS postdoctoral fellow, I have been able to complete two research papers on graph decompositions, one of which I had first started working on with my Ph.D. supervisor Chris Rodger at Auburn University about two years ago. At Memorial University of Newfoundland, with David Pike we have been working mainly on the structural properties of the block-intersection graphs of certain combinatorial designs. In particular, we have recently settled the complete spectrum for which two-fold triple systems with Hamiltonian 2-block-intersection graphs exist – a result that followed our previous paper where we obtained the complete spectrum for two-fold triple systems without Hamiltonian cycles in their 2-block-intersection graphs. These structures are interesting essentially in two ways. When they are considered from a coding theoretic point of view, they correspond to two-fold triple systems with/without cyclic 2-intersecting Gray codes, which have several applications in their own. Also, in a rather pure graph-theoretical setting these structures generate certain 3-regular graphs which are 3-connected if they are not disconnected. Our motivation was that studying the Hamiltonicity of these graphs might shed some light on the existence of the so called “snarks”, a certain type of graph that is encountered often in the study of many major problems in graph theory.

I have also enjoyed the opportunity to work with Karen Meagher through emails, after David Pike introduced me to the notions of zero-forcing and brushing in graphs. This collaboration proved to be fruitful as well, and resulted in a paper where we established an unexpected connection between the two notions, while we also proved a conjecture that

compares graphs and their line graphs from the perspective of zero-forcing. I have already presented many of these results during talks at local and international events, and I am looking forward to more opportunities to share these findings with the mathematics community around the world.

Robert Dawson to the Hall of Fame

Dr. Robert J. MacG. Dawson (BSc, Dalhousie University; PhD, Mathematics, University of Cambridge) has been inducted into the Science Atlantic Hall of Fame as an Outstanding Member for 2016. Dr. Dawson began his career at Saint Mary's University in 1989. He was chair of the Department of Mathematics and Computing Science from 2001-2004 and has helped organize conferences in geometry and category theory, as well as the 2013 Canadian Mathematical Society (CMS) summer meeting.

His connection with Science Atlantic (then APICS) goes back to his first year as a student at Dalhousie University in 1978, when, with Lorne Whiteway, he competed in the APICS Math Days problem solving contest. He participated in the competition each year during his undergraduate studies and made his first conference presentation at the annual event.

Now, as a faculty member, Dr. Dawson has represented Saint Mary's University on the Science Atlantic Mathematics and Statistics Committee for approximately 25 years, having served as Secretary (two terms), Vice Chair, and Chair (2005-2012).

Next CAIMS Meeting at Dalhousie

The 2017 Canadian Society of Applied and Industrial Mathematics (CAIMS) Annual Meeting will take place at Dalhousie University in Halifax, Nova Scotia, July 17-21, 2017. The main themes for the meeting are:

- Numerical Analysis
- Dynamical Systems and PDEs
- Data Analytics
- Fluid Dynamics
- Industrial Mathematics

Information about the meeting can be found on the webpage <http://caims2017.caims.ca/caims2017/welcome2017.html>

The organizers would like to invite CAIMS members to submit proposals for minisymposia, contributed talks, or posters, in the above themes, or in any other area of interest. The submission webforms can be found by clicking the submission tab on the above mentioned webpage.

New Appointment at Acadia Institute for Data Analytics

Christian Frey joined the Acadia Institute for Data Analytics as a Business / Data Analyst in July, 2016.

Christian Frey has an undergraduate degree in Business with Computer Science. He has recently graduated from Acadia, after coming to Nova Scotia from Warren, Vermont where he grew up. He has previously worked with the Town of Warren as an assistant to the town manager, as well a developer for a multi-media case website.

Recent and Upcoming Events

AARMS Workshops and Minicourses

International Category Theory Conference

Organizers: R. Blute, R. Cockett, P. Hofstra, R. Dawson, D. Pronk
Location: Dalhousie University and Saint Mary's University, Halifax
Date: August 7-13, 2016

Games at Dal 2016

Organizers: Richard Nowakowski and Urban Larsson
Location: Dalhousie University, Halifax
Date: August 9-23, 2016

Partial Differential Equations and Numerical Analysis at Atlantic Universities Conference

Organizers: George Chen et al
Location: Cape Breton University, Sydney
Date: October 16, 2016

Fifth Parallel-in-time Integration Workshop

Organizers: M. Emmett, M. Minion, M. Gander, R. Haynes, R. Krause
Location: Banff International Research Station
Date: November 27 – December 2, 2016

AARMS-Sponsored Events

Conference on Selected Areas in Cryptography and SAC Summer School

Organizer: Howard Heys et al
Location: Memorial University, St. John's
Date: August 8-12, 2016

PIMS Grad Math Modeling in Industry Workshop

Organizers: Michael Lamoureaux
Location: UBC Vancouver
Date: August 8-13, 2016

CanaDAM 2017

Organizers: Gary MacGillivray
Location: Ryerson University, Toronto
Date: June 12-16, 2017

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"The difference between the poet and the mathematician is that the poet tries to get his head into the heavens while the mathematician tries to get the heavens into his head."
— G.K. Chesterton