CT2016 Report for AARMS

It is now fifty years since the publication of William Lawvere's doctoral thesis as the article entitled, *"The Category of Categories as a Foundation for Mathematics"*. Although this was not the beginning of the development of category theory (which dates back to 1945), it provided a clear vision for the importance of category theory and a radically new approach toward the foundations of mathematics. This year's meeting of the annual category theory conference, Category Theory 2016, held in Halifax, was a showcase of the large variety in developments and applications of category theory in mathematics.

The meeting started with a welcome reception at the Lord Nelson Hotel on Sunday evening, August 7, 2016. The scientific program ran from Monday August 8 until Saturday August 13, as described in the attached schedule of talks. On Monday evening there was a public lecture on quantum computation, organized by the math department and featuring one of our participants, Dr. Jamie Vicary from the University of Oxford. On Wednesday afternoon there was an excursion with various options to explore the city and the harbor and on Thursday night the conference banquet was a lobster dinner at the Shore Club in Hubbards.

There were 84 registered participants from countries all around the world, including a large group from Australia and a large group from Japan. There were 14 participants from Atlantic Canada, 17 more from the rest of Canada, and 53 international participants, of which 12 came from the United States. The numbers were a bit lower than what is usual at Category Theory meetings.

This was primarily due to the unusual timing of the event, with the meeting being held in August rather than June or early July. This was due to the fact that we wanted to hold it after the AARMS Summer School.

The conference featured invited lectures by
- John Bourke (Masaryk University)
- Nicola Gambino (University of Leeds)
- André Joyal (Université de Quebec à Montréal)
- Dorette Pronk (Dalhousie University)
- Catharina Stroppel (University of Bonn)
- Dominic Verity (Macquarie University)

The average age of the participants at this meeting was considerably lower than at previous years. Joyal and Tierney, two of our older participants, commented on this during the welcome reception and remarked how this felt like the old days when they came to meetings excited to talk about the new structures they had discovered. Part of the reason that we had a larger number of graduate students and early

career researchers present was the fact that we had held the AARMS Summer School with two category theory courses during the four weeks before the meeting. There was a large number of talks given by graduate students and recent graduates, most of a very high quality and covering a broad range of areas within category theory and its applications. The general atmosphere of the conference was very open and friendly and there were a lot of research discussions being held over coffee and between sessions. This was very encouraging and bodes well for the field.

The conference was co-hosted by two universities: Dalhousie University and Saint Mary's University. This worked very well and gave people a bit of variety. The beautiful weather this summer also contributed in making this conference a great experience. It looked for a moment as if we would not be able to host our excursion to McNab's Island due to the risk of forest fires, but we were finally allowed to go with two local guides who provided the participants with an enjoyable and informative tour.

Scientifically, this meeting showcased both the breadth and depths of current research in category theory. We highlight here a couple of topics and talks that stood out to us as organizers.

Susan Niefield's characterization of exponentiable objects in additive categories showed a great culmination of her work with Richard Wood on this topic.

The connection between category theory and geometry (both differential and algebraic) through (Cartesian) differential and integral categories has been a recurring theme in previous category theory meetings, but this meeting saw a very large number of talks in this area with significant breakthroughs. These categorical structures were originally developed to study certain types of linear logic, but are now used to give algebraic foundations for geometry and homotopy theory. This was most evident in the talk by Emily Riehl (from Johns Hopkins University), which was joint work with a group of algebraic topologists (done as part of the Women in Topology workshop at BIRS in April of this year). She showed that the abelian functor calculus naturally forms a Cartesian differential category (which is one of the structures that came out of the work on semantics of differential linear logic).

There were several strong presentations on new developments of the theory of higher categories and the relations with homotopy type theory as well.
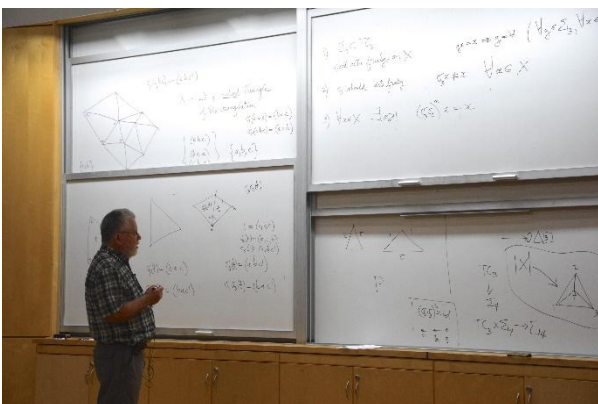
Less expected applications of category theory were presented by Andre Joyal and Clemens Berger. Clemens Berger presented a way to represent hyperplane arrangements by so called graphic monoids and then proceeded to further categorify this to a moment category and make connections between the resulting categorical structure and the categories used in the study of higher homotopy theory and topos theory. Andre Joyal presented us with a classifying topos for Penrose tilings, showing us that the concept of Penrose tiling is geometric in the topos theoretic sense.

Another noteworthy development we witnessed were talks on truly new applications of category theory outside of mathematics: industrial scheduling (by Spencer Breiner), fibred signal representation (by Salil Samant), and a new view on machine learning and big data analytics through a new (categorical) understanding of the link between kernel functions and reproducing kernel Hilbert spaces.
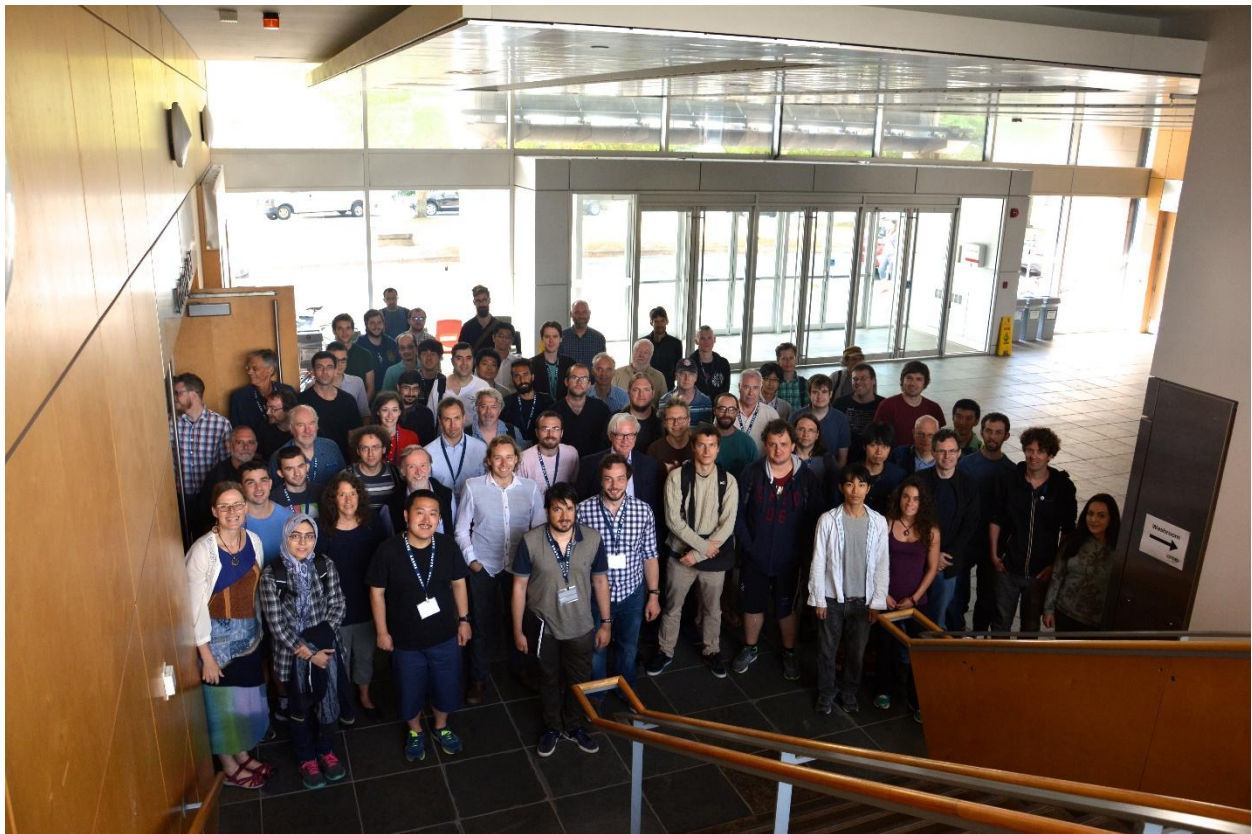
Expenditures

Accommodation A. Joyal (invited speaker)	1027
Travel N. Gambino (invited speaker)	905.25
Travel J. Bourke (invited speaker)	1,043.15
Lord Nelson Hotel for Invited Speakers	5660.79
Clicker	103.49
Meeting Space Dalhousie University	1731.2
Coffee Breaks Dalhousie University	2639.28
Conference Stationary	175.27
Secretarial assistance	824.73
Meeting Space + Catering Saint Mary's University	2002.97
Conference Program Booklets	162.5
Conference Banquet	4878.65
Ambassatours (bus to banquet)	1350
Accommodations	7574.9
Travel support for students	2594.73
Bus tickets for excursion	20
Coffee for excursion	34.96
excursion tickets for the citadel	35.65
McNab's Island ferry	1070.49
Total:	**33835.01**

Revenue

Dalhousie Math Department	1,000
Dalhousie Faculty of Science	2,000
Dalhousie President's Office	2,500
Saint Mary's Office of the President	1,175
Saint Mary's Dean of Graduate Studies and Research	1,000
Saint Mary's Dean of Science	1,000
Registrations	13119.39
Payment for Accommodations	3604.62
Payment for Dinner Tickets	936
AARMS	7500
Total:	**33,835.01**