

SMS 2015: Director's report.

The 54th *Séminaire de Mathématiques Supérieures* took place in Montréal in the period June 15-July 26, 2015. Touching on a diverse spectrum of themes related to spectral theory, the school was distinguished not only by the excellence of the speakers and students but also by an innovative structure with 19 speakers out of which 7 were junior. This allowed for a particularly interactive activity that consisted not only of mini-courses but also computer labs as well as short presentations by the junior researchers. It all led to a stimulating and intense school.

The organizers, **Alexandre Girouard**, **Dmitry Jakobson**, **Michael Levitin**, **Nilima Nigam**, **Iosif Polterovich**, and **Frédéric Rochon** have done a terrific job in putting together this diverse and exciting program. I thank all of them for their hard work as well as **Ms. Sakina Benhima** from the CRM who assisted them and me with the administrative matters required in running this activity.

As in past years, this edition of the *SMS* was only possible with the co-operation of our main partners the **CRM**, **Fields Institute**, **PIMS** and **MSRI** as well as with support from the **ISM**, the **University of Montreal**, the **Analysis Laboratory** of the CRM and with support from the **Canadian Mathematical Society**. I thank all these institutions for their contributions and I also thank the board of directors of the SMS for their work and support.

In the following you will find a detailed scientific, organizational and budgetary report. I thank again the organizers for taking the time to prepare this document.

Sincerely Yours,



Octav Cornea
Director, Séminaire de Mathématiques Supérieures
cornea@dms.umontreal.ca

September 14, 2014

**2015 Séminaire de mathématiques supérieures:
Geometric and Computational Spectral Theory**

June 15 - June 26, 2015

1. ORGANIZERS

Alexandre Girouard (Université Laval), Dmitry Jakobson (McGill University), Michael Levitin (University of Reading), Nilima Nigam (Simon Fraser University), Iosif Polterovich (Université de Montréal), Frédéric Rochon (UQÀM).

2. INVITED SPEAKERS

I. Minicourse lecturers:

Gregory Berkolaiko (Texas A&M): *Interlacing eigenvalue inequalities and counting zeros of graph eigenfunctions.*

Dorin Bucur (Chambéry): *Optimization and spectral inequalities.*

Bruno Colbois (Neuchâtel): *The spectrum of the Laplacian: a geometric approach.*

Chen Greif (UBC): *Numerical Solution of Linear Eigenvalue Problems.*

Daniel Grieser (Oldenburg): *Asymptotics of eigenvalues on thin things.*

Colin Guillarmou (ENS): *A scattering theory approach for X-ray tomography.*

Bernard Helffer (Paris-Sud): *On nodal partitions and minimal spectral partitions (an introduction).*

Guido Kanschat (Heidelberg): *Finite element approximation of eigenvalue problems.*

Richard Melrose (MIT): *Laplacians degenerating at a point and gluing.*

Richard Schoen (Stanford): *The spectral geometry of the Dirichlet-Neumann operator.*

Mikhail Sodin (Tel Aviv): *Random Nodal Portraits.*

Alexander Strohmaier (Loughborough): *Computation of Eigenvalues, Spectral Zeta Functions and Zeta-Determinants on Hyperbolic Surfaces.*

II. Invited junior speakers:

Eldar Akhmetgaliyev (Caltech): *Integral equation methods for spectral problems.*

Yaiza Canzani (Harvard): *Zero sets of monochromatic random waves.*

Semyon Dyatlov (MIT): *Spectral gaps via additive combinatorics.*

Asma Hassannezhad (Max Planck Institute): *Counting function and multiplicity of the Laplacian eigenvalues*

Corentin Léna (Università degli studi di Torino): *On the number of nodal domains for flat tori.*

Romain Petrides ((Universit de Lyon 1): *Existence and regularity of maximal metrics for the Laplace eigenvalues on surfaces.*

David Sher (University of Michigan): *The Steklov spectrum of surfaces.*

3. SUMMARY

Perhaps the largest school in spectral geometry since the late nineties, this event brought together students and internationally renowned experts in the geometric and computational aspects of spectral theory. The area of spectral theory has fascinated mathematicians and physicists for centuries, and recent years have seen remarkable progress in several branches of the field. The school consisted of twelve minicourses focussing on four main themes: geometry of eigenvalues, geometry of eigenfunctions, computational spectral theory and spectral theory on singular spaces. Inside each theme, three minicourses were given, typically one 4-hour minicourse at the introductory level and two more advanced 3-hour minicourses. A particular emphasis was made on the interplay between the four main topics of the school, notably between the computational and the geometric part — which was one of the most novel aspects of the school. The minicourses were complemented by exercise sessions, computer labs and short (25 minutes) presentations by selected junior participants who have already made important contributions to the subject.

4. RECORD OF ACTIVITIES

To orient students with the basics, Week 1 of the summer school began with an introduction by Bruno Colbois to important ideas in the geometry of the Laplace spectrum on compact Riemannian manifolds. Initially, he emphasized the major results, discussing in depth their implications before getting into technical details. This proved helpful to provide an overview for the students, many of which discussed the lectures during the breaks. Over the course of 4 lectures on Monday and Tuesday, Colbois showed the audience key results and techniques in the area, revealing deep geometric insights and sharing open problems. He also organized an open problem session on Monday evening.

In the afternoons on Monday and Tuesday, Guido Kanschat provided an introduction to the finite element approximation theory for eigenproblems. Starting from the basic variational setting, Kanschat showed the importance of designing discretization schemes appropriate for the operator under consideration. For many students, this was the first exposure to numerical analysis in this setting. To aid them, Kanschat designed and conducted computer lab exercises using the deal-ii open source software. Students in the labs were excited to be able to 'see' eigenfunctions for the Laplacian on unusual geometries, and to manipulate boundary conditions. A positive outcome was the 'cross-fertilization' - some students with a priori computing

backgrounds ended up working with students whose training was in geometric spectral theory. Such interactions bode well for the future of the field.

On Tuesday evening, Eldar Akhmetgaliyev presented recent progress in the use of boundary integral techniques for very high-accuracy calculations of spectra, including for the mixed and Steklov problems. These rely on detailed knowledge of the asymptotic behaviour of solutions near singularities, which in turn relies on understanding the geometry of such eigenfunctions. David Sher presented recent work on spectral asymptotics for the Steklov eigenvalues; the results are intriguingly sharp. The pair of lectures highlighted the strengths as well as complementary natures of the approaches.

Starting on Wednesday, Dorin Bucur lectured on isoperimetric inequalities from a shape optimization point of view, allowing for elegant proofs of classical results. Richard Schoen presented more advanced lectures on the spectral geometry of the Dirichlet-Neumann operator and its deep relationship with the problem of finding free boundary minimal surfaces in the ball, bringing the students the state-of-the-art. On Wednesday and Thursday Chen Grief provided an introduction to the field of discrete eigenvalue computation. Since the eigenvalues of a general matrix larger than 5×5 cannot be found explicitly, approximation is key. Once again, it is important to design the correct algorithm for a given operator. Grief showed examples where even well-known eigenvalue methods will fail on problems which do not meet the assumptions for the algorithms' convergence. On Friday, Gregory Berkolaiko presented some fascinating lectures on the relation between graph eigenvalues and interlacing eigenvalue inequalities. These were very accessible, and Berkolaiko ensured the audience understood the key ideas by using interesting computer animations and simple exercises. Berkolaiko concluded his lecture series the following Monday with two very interesting lectures on zeros of graph eigenfunctions, as well as on related problems in Mathematical Physics (including the study of graphene).

The second week of the SMS started with a series of talks by Dan Grieser on eigenvalue asymptotic on “thin things,” where he explained how to obtain complete asymptotic expansions of eigenvalues of the Laplacian on domains which are close to one-dimensional, for example fat graphs and thin triangles. Dan's lectures also included an introduction to spectral theory on manifolds with corners; he concluded his lectures on Tuesday.

On Monday and Tuesday, Colin Guillarmou gave a series of lectures on a scattering theory approach for X-ray tomography. He discussed how ideas from scattering theory can be applied to study the problem of injectivity of the X-ray transform and application to boundary rigidity problems. A surprising feature originally due to Pestov-Uhlmann is that in dimension 2, there are strong connections between the Dirichlet-to-Neumann operator for the Laplacian and X-ray transform.

On Wednesday, Mikhail Sodin started his lectures titled “Random Nodal Portraits.” He described the progress and challenges of understanding the zero sets of smooth Gaussian random functions of several real variables.

Examples included various ensembles of Gaussian real-valued polynomials (algebraic or trigonometric) of large degree, and smooth Gaussian functions on the Euclidean space with translation-invariant distribution. The lectures, which continued on Thursday and on Friday, were based on joint works with Fedor Nazarov.

Next, Richard Melrose started his lecture series on “Laplacians degenerating at a point and gluing.” He talked about the behaviour of the Laplace operator for metrics degenerating at a point, especially as related to “gluing constructions” in Riemannian geometry. Examples of degenerations included those obtained by approaching the boundary on the moduli spaces of Riemann surfaces. Some background material for those lectures was previously introduced in the lectures of Dan Grieser. The lectures continued on Thursday and Friday.

In the afternoon, Alex Strohmaier started his lecture series titled “Computation of Eigenvalues, Spectral Zeta Functions and Zeta Determinants on Hyperbolic Surfaces.” In the first lecture, he discussed how the method of particular solutions can be used to compute eigenvalues of the Laplace operator on Riemannian manifolds, including hyperbolic surfaces. The second lecture was devoted to the computation of spectral invariants such as the spectral Zeta function and the Zeta regularized determinant of the Laplace operator. The third lecture (given on Thursday) concerned Dirichlet-to-Neumann map and applications to the study of resonances for non-compact manifolds.

In the afternoon, Corentin Lena gave a talk about the number of nodal domains for flat tori. He concentrated on studying Courant-sharp eigenfunctions, as well as on a question raised by T. Hoffmann-Ostenhof in 2012: are there eigenfunctions having an odd number of nodal domains. The day ended by Dmitry Jakobson’s survey lecture on Dynamics, Geometry and Spectral Theory; the lecture included videos of Chladni plates.

On Thursday, Bernard Helffer started his lectures on nodal partitions and minimal spectral partitions. The first lecture concentrated on examples and methods of the study of eigenfunctions with the Courant sharp property. Bernard first reviewed basic spectral theorems: Courant, Pleijel, Weyl, Faber-Krahn and application to the analysis of the Courant sharp situation. In the second lecture (given on Friday), he gave an introduction to minimal partitions, main theorems and examples. The third lecture concerned the magnetic characterization of minimal partitions and applications.

Thursday concluded with two lectures by young researchers. Asma Hassannezhad lectures on counting function and multiplicity of the Laplacian eigenvalues. She discussed the study of geometric upper bounds for the multiplicity and counting function of the Laplacian eigenvalues, including some of classical upper bounds due to Cheng, Gromov and Buser, and extensions to domains with Dirichlet and Neumann boundary conditions. Semyon Dyatlov discussed a novel application of methods from additive combinatorics

to the study of spectral gaps on convex co-compact hyperbolic surfaces. Using a fractal uncertainty principle, the size of this gap was expressed via an improved bound on the additive energy of the limit set, making it possible to calculate the size of the gap for a given surface.

On Friday, Sodin, Melrose and Helffer concluded their lectures. In the afternoon, there were two talks by young researchers. In the first talk, Romain Petrides discussed existence and regularity of maximal metrics for the Laplace eigenvalues on surfaces, an old question studied since 1980s by Hersch, Yau, Li, Yang and many others. He also give the link between this problem and minimal immersions into spheres. Yaiza Canzani gave the last talk of the conference. She discussed the structure of zero sets of monochromatic random waves, discussing recent extensions of results of Nazarov and Sodin by Sarnak, Wigman and herself.

5. ORGANIZATION

The school featured about 90 participants (including the speakers and the local participants) from 13 countries spanning five continents. The speakers featured some of the world leading researchers, including two ICM plenary speakers. The non-local junior participants were selected mainly on the basis of the relevance of their research background to the topic of the school. A vast majority of non-local junior participants received financial support that allowed to cover accommodation for the duration of the school. There were 12 women among the participants, including one organizer and two invited junior speakers.

6. PARTICIPANTS

ORGANIZERS	
Alexandre Girouard	Université Laval
Dmitry Jakobson	McGill University
Michael Levitin	University of Reading
Nilima Nigam	Simon Fraser University
Iosif Polterovich	Université de Montréal
Frédéric Rochon	UQAM
SPEAKERS	Affiliation
Gregory Berkolaiko	Texas A&M University
Dorin Bucur	Université de Savoie
Bruno Colbois	Université de Neuchâtel
Chen Greif	UBC
Daniel Grieser	Univeristy of Oldenburg
Collin Guillarmou	ENS Paris
Bernard Helffer	Université Paris-Sud
Guido Kanschat	Universität Heidelberg
Richard Melrose	MIT
Richard Schoen	Stanford University
Mikhail Sodin	Tel Aviv University
Alexander Strohmaier	Loughborough University
YOUNG SPEAKERS	
Asma Hassannezhad	Max Planck Institute
Eldar Akhmetgaliyev	Caltech
Yaiza Canzani	McGill
Semyon Dyatlov	MIT
Romain Petrides	Université de Lyon 1
David Sher	University of Michigan

PARTICIPANTS	Affiliation
Aiello Gordon	University of Iowa
Ariturk Sinan	Rice University
Armstrong Gavin	University of Oregon
Bei Francesco	Humboldt Universitat zu Berlin
Berger Amandine (F)	Université de Neuchâtel
Booton Laura (Berkolaiko)	Texas A&M University
Cameron Thomas	Washington State University
Causley Broderick	Higher School of Economics
Cecchini Simone	Northeastern University
Cheng Da Rong	Stanford University
Chung Jooyeon F	University of Illinois, Urbana-Champaign
Coleman Neal	Indiana University
Fang Yang-Long	University College London
Fedosova Ksenia (F)	Bonn University
Flynn Steven	UC Santa Cruz
Fritsch Karsten	University College London
Ghorbanpour Asghar	Western University
Gittins Katie (F)	University of Bristol
Gomes Sean (Andrew Hassel)	Australian National University
Greverath Désirée (F)	Stanford University
Honghao Gao	Northwestern University
Joyner Chris	Queen Mary University of London
Karakoc Selcuk	Tulane University
Karpukhin Mikhail	McGill University
Kinzebulatov Damir	University of Toronto
Lee Gihyun	Seoul National University
Lee Ho Jun	Seoul National University
Lee Minjae	UC Berkeley
Lena Corentin	Universita degli studi di Torino
Li Chao	Stanford University
Liu Wen (Berkolaiko)	Texas A&M University
Lungenstrass Tomàs	Pontificia Universidad Católica de Chile
Lvovski Yuri	The Hebrew University of Jerusalem
Morgan Katrina	University of North Carolina
Muckerman Dylan	University of North Carolina at Chapel Hill
Nasserden Dillon	Simon Fraser University
Orduz Juan	Humboldt Universität zu Berlin
Otero Ignacio	CINVESTAV-IPN
Ozturk Hasen	University of Reading
Petiard Luc	Université de Neuchâtel
Ponge Raphaël	Seoul National University
Rayko Arseniy	Lomonosov Moscow State University
Savale Nikhil	University of Notre-Dame

Schenck Emmanuel	Paris 13
Shestakov Ivan	University of Oldenburg
Shi Pengshuai	Northeastern University
Sukhtaiev Selim	University of Missouri - Columbia
Tian Bo	University of Maryland
Tran Nhan	Kansas State University
Valero Carlos	Universidad de Guanajuato
Voss Saskia(F)	Universität Bonn
Wolf Robert	University of Kentucky
Yi Yan	University of Kansas

Late registrations	Affiliation
Craig Gordon	Université Laval
Fiset Marc-Antoine	McGill University
Galkowski Jeffrey	CRM
Labrie Marc-Antoine	Université de Montréal
Lagacé Jean	Université de Montréal
Lu Siyuan	McGill University
Mahdi Ammar	UQAM
Medeiros-Charbonneau Michael	McGill University
Moisan-Roy Patrice	Université Laval
Poliquin Guillaume	Université de Montréal
Roy Simon-Pierre	Université Laval
Roy-Fortin Guillaume	Université de Montréal
Selmani Sam	McGill University

7. PROGRAM

Semaine/Week I

Lundi 15 juin

- 08:00-09:30 Inscription et café croissants /Registration and Coffee & Croissants (Room 1221)
09:30-10:30 **Bruno Colbois** (Univ de Neuchâtel)
“The spectrum of the Laplacian: a geometric approach I”
10:30-10:45 Pause-café / Coffee break (Salle / Room 1221)
10:45-11:45 **Bruno Colbois** (Univ de Neuchâtel)
“The spectrum of the Laplacian: a geometric approach II”
11:45-13:30 Pause-déjeuner / Lunch break
13:30-14:30 **Guido Kanschat** (Universität Heidelberg)
“Finite element approximation of eigenvalue problems I”
14:30-14:45 Pause-café / Coffee break (Salle / Room 1221)
14:45-15:45 **Guido Kanschat** (Universität Heidelberg)
“Finite element approximation of eigenvalue problems II”
15:45-16:15 Pause-café / Coffee break (Salle / Room 1221)
16 :15- Exercices / Discussions

Mardi 16 juin

- 09:00-09:30 Café croissants / Coffee & Croissants (Room 1221)
09:30-10:30 **Bruno Colbois** (Univ de Neuchâtel)
“The spectrum of the Laplacian: a geometric approach III”
10:30-10:45 Pause-café / Coffee break (Salle / Room 1221)
10:45-11:45 **Bruno Colbois** (Univ de Neuchâtel)
“The spectrum of the Laplacian: a geometric approach IV”
11:45-13:30 Pause-déjeuner / Lunch break
13:30-14:30 **Guido Kanschat** (Universität Heidelberg)
“Finite element approximation of eigenvalue problems III”
14:30-14:45 Pause-café / Coffee break (Salle / Room 1221)
14:45-15:45 **Guido Kanschat** (Universität Heidelberg)
“Finite element approximation of eigenvalue problems IV”
15:45-16:15 Pause-café / Coffee break (Salle / Room 1221)
16:15-16:40 **Eldar Akhmetgaliyev** (California Institute of Technology)
“Integral equation methods for spectral problems”
16:45-17:10 **David Sher** (University of Michigan)
17:30- Cocktail de bienvenue/Welcoming Reception

Mercredi 17 juin

- 09:00-09:30 Café croissants / Coffee & Croissants (Room 1221)
09:30-10:30 **Dorin Bucur** (Université de Savoie)
“Shape optimization and spectral inequalities I”
10:30-10:45 Pause-café / Coffee break (Salle / Room 1221)
10:45-11:45 **Richard Schoen** (Stanford University)
“The spectral geometry of the Dirichlet-Neumann operator I”
11:45-13:30 Pause-déjeuner / Lunch break
13:30-14:30 **Chen Greif** (University of British Columbia)
“Numerical Solution of Linear Eigenvalue Problems I”
14:30-14:45 Pause-café / Coffee break (Salle / Room 1221)
14:45-15:45 **Chen Greif** (University of British Columbia)
“Numerical Solution of Linear Eigenvalue Problems II”
15:45-16:15 Pause-café / Coffee break (Salle / Room 1221)
16:15- Exercices / Discussions

Jeudi 18 juin

- 09:00-09:30 Café croissants / Coffee & Croissants (Room 1221)
09:30-10:30 **Dorin Bucur** (Université de Savoie)
“Shape optimization and spectral inequalities II”
10:30-10:45 Pause-café / Coffee break (Salle / Room 1221)
10:45-11:45 **Richard Schoen** (Stanford University)
“The spectral geometry of the Dirichlet-Neumann operator II”
11:45-13:30 Pause-déjeuner / Lunch break
13:30-14:30 **Chen Greif** (University of British Columbia)
“Numerical Solution of Linear Eigenvalue Problems III”
14:30-14:45 Pause-café / Coffee break (Salle / Room 1221)
14:45-15:45 **Chen Greif** (University of British Columbia)
“Numerical Solution of Linear Eigenvalue Problems IV”
15:45-16:15 Pause-café / Coffee break (Salle / Room 1221)
16:15- Exercices / Discussions

Vendredi 19 juin

- 09:00-09:30 Café croissants / Coffee & Croissants (Room 1221)
- 09:30-10:30 **Dorin Bucur** (Université de Savoie)
“Shape optimization and spectral inequalities II”
- 10:30-10:45 Pause-café / Coffee break (Salle / Room 1221)
- 10:45-11:45 **Richard Schoen** (Stanford University)
“The spectral geometry of the Dirichlet-Neumann operator II”
- 11:45-13:30 Pause-déjeuner / Lunch break
- 13:30-14:30 **Gregory Berkolaiko** (Texas A&M University)
“Interlacing eigenvalue inequalities and counting zeros of graph eigenfunctions I”
- 14:30-14:45 Pause-café / Coffee break (Salle / Room 1221)
- 14:45-15:45 **Gregory Berkolaiko** (Texas A&M University)
“Interlacing eigenvalue inequalities and counting zeros of graph eigenfunctions II”
- 15:45-16:15 Pause-café / Coffee break (Salle / Room 1221)
- 16:15- Exercices / Discussions

Semaine/Week II

Lundi 22 juin

- 09:00-09:30 Café croissants / Coffee & Croissants (Room 1221)
- 09:30-10:30 **Daniel Grieser** (Carl von Ossietzky Universität Oldenburg)
“Asymptotics of eigenvalues on thin things I”
- 10:30-10:45 Pause-café / Coffee break (Salle / Room 1221)
- 10:45-11:45 **Daniel Grieser** (Carl von Ossietzky Universität Oldenburg)
“Asymptotics of eigenvalues on thin things II”
- 11:45-13:30 Pause-déjeuner / Lunch break
- 13:30-14:30 **Gregory Berkolaiko** (Texas A&M University)
“Interlacing eigenvalue inequalities and counting zeros of graph eigenfunctions III”
- 14:30-14:45 Pause-café / Coffee break (Salle / Room 1221)
- 14:45-15:45 **Gregory Berkolaiko** (Texas A&M University)
“Interlacing eigenvalue inequalities and counting zeros of graph eigenfunctions IV”
- 15:45-16:15 Pause-café / Coffee break (Salle / Room 1221)
- 16:15-17:15 **Colin Guillarmou** (École Normale supérieure)
“A scattering theory approach for X-ray tomography I”

Mardi 23 juin

- 09:00-09:30 Café croissants / Coffee & Croissants (Room 1221)
- 09:30-10:30 **Daniel Grieser** (Carl von Ossietzky Universität Oldenburg)
“Asymptotics of eigenvalues on thin things II”
- 10:30-10:45 Pause-café / Coffee break (Salle / Room 1221)
- 10:45-11:45 **Daniel Grieser** (Carl von Ossietzky Universität Oldenburg)
“Asymptotics of eigenvalues on thin things IV”
- 11:45-13:30 Pause-déjeuner / Lunch break
- 13:30-14:30 **Colin Guillarmou** (École Normale supérieure)
“A scattering theory approach for X-ray tomography II”
- 14:30-14:45 Pause-café / Coffee break (Salle / Room 1221)
- 14:45-15:45 **Colin Guillarmou** (École Normale supérieure)
“A scattering theory approach for X-ray tomography I”
- 15:45-16:15 Pause-café / Coffee break (Salle / Room 1221)
- 16:15- Exercices / Discussions

Mercredi 24 juin

- 09:00-09:30 Café croissants / Coffee & Croissants (Room 1221)
- 09:30-10:30 **Mikhail Sodin** (Tel-Aviv University)
“Random Nodal Portraits I”
- 10:30-10:45 Pause-café / Coffee break (Salle / Room 1221)
- 10:45-11:45 **Richard Melrose** (MIT)
“Laplacians degenerating at a point and gluing I”
- 11:45-13:30 Pause-déjeuner / Lunch break
- 13:30-14:30 **Alexander Strohmaier** (Loughborough University)
“Computation of Eigenvalues, Spectral Zeta Functions and Zeta-Determinants on Hyperbolic Surfaces I”
- 14:30-14:45 Pause-café / Coffee break (Salle / Room 1221)
- 14:45-15:45 **Alexander Strohmaier** (Loughborough University)
“Computation of Eigenvalues, Spectral Zeta Functions and Zeta-Determinants on Hyperbolic Surfaces II”
- 15:45-16:15 Pause-café / Coffee break (Salle / Room 1221)
- 16:15-16:40 **Corentin Lena** (Università degli studi di Torino)
“On the number of nodal domains for flat tori”
- 16:45- Exercices / Discussions

Jeudi 25 juin

- 09:00-09:30 Café croissants / Coffee & Croissants (Room 1221)
- 09:30-10:30 **Mikhail Sodin** (Tel-Aviv University)
“Random Nodal Portraits II”
- 10:30-10:45 Pause-café / Coffee break (Salle / Room 1221)
- 10:45-11:45 **Richard Melrose** (MIT)
“Laplacians degenerating at a point and gluing II”
- 11:45-13:30 Pause-déjeuner / Lunch break
- 13:30-14:30 **Alexander Strohmaier** (Loughborough University)
“Computation of Eigenvalues, Spectral Zeta Functions and Zeta-Determinants on Hyperbolic Surfaces III”
- 14:30-14:45 Pause-café / Coffee break (Salle / Room 1221)
- 14:45-15:45 **Bernard Helffer** (Université Paris-Sud)
“On nodal partitions and minimal spectral partitions (an introduction) I”
- 15:45-16:15 Pause-café / Coffee break (Salle / Room 1221)
- 16:15-16:40 **Asma Hassannezhad** (Max-Planck Institute for Mathematics)
“Counting function and multiplicity of the Laplacian eigenvalues”
- 16:45-17:10 **Semyon Dyatlov** (UC Berkeley) “Spectral gaps via additive combinatorics”

Vendredi 26 juin

- 09:00-09:30 Café croissants / Coffee & Croissants (Room 1221)
- 09:30-10:30 **Mikhail Sodin** (Tel-Aviv University)
“Random Nodal Portraits III”
- 10:30-10:45 Pause-café / Coffee break (Salle / Room 1221)
- 10:45-11:45 **Richard Melrose** (MIT)
“Laplacians degenerating at a point and gluing III”
- 11:45-13:30 Pause-déjeuner / Lunch break
- 13:30-14:30 **Bernard Helffer** (Université Paris-Sud)
“On nodal partitions and minimal spectral partitions (an introduction) II”
- 14:30-14:45 Pause-café / Coffee break (Salle / Room 1221)
- 14:45-15:45 **Bernard Helffer** (Université Paris-Sud)
“On nodal partitions and minimal spectral partitions (an introduction) III”
- 15:45-16:15 Pause-café / Coffee break (Salle / Room 1221)
- 16:15-16:40 **Romain Petrides** (Institut Camille Jordan)
“Existence and regularity of maximal metrics for the Laplace eigenvalues on surfaces”
- 16:45-17:10 **Yaiza Canzani** (McGill University)
“Zero sets of monochromatic random waves”

APPENDIX : BUDGET

a. Summary

FUNDING SUPPORT

CRM	\$ 20 000
FIELDS	\$ 10 000
PIMS	\$ 10 000
ISM	\$ 7 500
MSRI	\$ 20 000
CMS	\$ 2 000
ANALYSIS LAB	\$ 8 000
REGISTRATION FEES	\$ 1 200

Total support : \$ 78 700

SUMMARY OF EXPENSES

Media, Poster	\$ 1 856,85
Receptions, meals	\$ 3 671,11
Student housing and travel	\$ 37680
Speakers housing	\$ 15 532,96
Speakers other expenses	\$ 17 406,36
Staff	\$ 1 120

Total expenditures: \$77267.28

(the expenditures are adjusted to take into account the MSRI arrangement – reimbursement of housing costs to the CRM and reimbursement of travel costs directly to the students; the MSRI contribution of 20000\$ appears at the same level in both support and expenditures)

b. Expenditures for each participant

ORGANIZERS		Hotel, Travel and living expenses
Alexandre Girouard	Université Laval	1125,00\$
Dmitry Jakobson	McGill University	
Michael Levitin	University of Reading	1335,21
Nilima Nigam	Simon Fraser University	1 978,2 \$
Iosif Polterovich	Université de Montréal	
Frédéric Rochon	UQAM	
SPEAKERS		Affiliation
Gregory Berkolaiko	Texas A&M University	2860,00
Dorin Bucur	Université de Savoie	2800,00
Bruno Colbois	Université de Neuchâtel	2625,00
Chen Greif	UBC	1662,98
Daniel Grieser	Univeristy of Oldenburg	2850,00
Collin Guillarmou	ENS Paris	Paid by the UMI
Bernard Hellfer	Université Paris-Sud	2435,00
Guido Kanschat	Universität Heidelberg	3100,00
Richard Melrose	MIT	1054,34
Richard Schoen	Stanford University	1660,00
Mikhail Sodin	Tel Aviv University	708,10
Alexander Strohmaier	Loughborough University	3290,00
YOUNG SPEAKERS		
Asma Hassannezhad	Max Planck Institute	480
Eldar Akhmetgaliyev	Caltech	480
Yaiza Canzani	McGill	1 193,59 \$
Semyon Dyatlov	MIT	
Romain Petrides	Université de Lyon 1	1420,00
David Sher	University of Michigan	580,00
TOTAL SPEAKERS		32 939,32,00

PARTICIPANTS	Affiliation		
Aiello Gordon	University of Iowa	MSRI	480,00\$
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