Calendar of activities

SEPTEMBER 2018

Week of September 3-7

September 5: Mini-course, 15:00 – 17:00
CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 5340

Marcello Porta, University of Tübingen

"Aspects of transport in many-body quantum systems" – Part I

In the last few years there has been important progress on the rigorous understanding of charge transport for many-body quantum systems. The goal of these lectures is to review some of this progress, for interacting fermionic lattice models. I will mostly focus on the integer quantum Hall effect, a paradigmatic example of quantum transport in two dimensions. In particular, I will discuss a proof of the quantization of the interacting Hall conductivity, based on fermionic cluster expansion techniques combined with Ward identities. If time permits, open problems will be discussed.

September 6: Mini-course, 15:00 – 17:00
CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 5340

Marcello Porta, University of Tübingen

"Aspects of transport in many-body quantum systems" – Part II

September 7: Colloque des Sciences Mathématiques du Québec, 16:00 – 17:00
CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 6254

Kasia Rejzner, University of York

"Mathematical challenges in constructing quantum field theory models"

This talk is an overview of algebraic quantum field theory (AQFT) and its perturbative generalization: pAQFT. Both are axiomatic systems meant to provide foundations for quantum field theory (the theory underlying particle physics). I will explain what is the current status of constructing physically relevant models in both approaches and present future perspectives. The most recent results include applications of pAQFT in Yang-Mills theories and effective quantum gravity, as well as some progress in understanding how to go beyond the perturbation theory.

Week of September 10-14

Many-Body Quantum Mechanics workshop.
www.crm.umontreal.ca/2018/Mecanique18/

September 10, 12 & 13: Aizenstatd Chair series of lectures
Robert Seiringer (IST Austria)
www.crm.umontreal.ca/act/theme/theme_2018_1_en/Seiringer_e.php
10 septembre : CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 1140
12 & 13 septembre : CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 6254

September 14: Colloque des Sciences Mathématiques du Québec, 16:00 – 17:00
CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 6254

Sylvia Serfaty, Courant Institute

"Systems of points with Coulomb interactions"

Large ensembles of points with Coulomb interactions arise in various settings of condensed matter physics, classical and quantum mechanics, statistical mechanics, random matrices and even approximation theory, and they give rise to a variety of questions pertaining to analysis, Partial Differential Equations and probability. We will first review these motivations, then present the "mean-field" derivation of effective models and equations describing the system at the macroscopic scale. We then explain how to analyze the next order behavior, giving information on the configurations at the microscopic level and connecting with crystallization questions, and finish with the description of the effect of temperature.

Week of September 17-21

- Entanglement, Integrability and Topology in Many-Body Systems workshop
www.crm.umontreal.ca/2018/Intrication18/

September 21: Séminaire, 15 :00 – 16 :00
CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 6254

Martin Fraas, Virginia Tech

"An index theory for many body quantum systems"

Indices are the main tool to classify topology of gapped quantum systems; Two systems with a different value of an index cannot be connected by a continuous transformation. The quantum Hall conductance is the canonical example. For non-interacting systems this conductance can be mathematically expressed as an index of two projections. In this talk, we give a generalisation of this theory to systems with interactions. This is a join work with S. Bachmann, A. Bols and W. de Roeck.

Week of September 24-28

September 24, 25 & 27: Aizenstatd Chair series of lectures
Michael Aizenman (Princeton University)
www.crm.umontreal.ca/act/theme/theme_2018_1_en/aizenman_e.php
CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 1140

September 26: Mini-course, 16:00 – 18:00
CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 1360

Giovanni Jona-Lasinio, Sapienza University of Rome

"Towards a non-equilibrium thermodynamics: macroscopic fluctuation theory" – Part I

Far from equilibrium behavior is ubiquitous. Indeed most of the processes that characterize energy flow occur far from equilibrium. These range from very large systems, such as weather patterns or ocean currents that remain far from equilibrium owing to an influx of energy, to biological structures. Away-from-equilibrium processes occur on time scales ranging from nanoseconds to millennia. Despite the pervasiveness of non-equilibrium systems and processes, our current understanding is far from complete. The macroscopic fluctuation theory deals with diffusive systems for which provides natural non-equilibrium thermodynamic functionals whose singularities are associated with phase transitions. It is based on a single formula for the probability of joint fluctuations of thermodynamic variables and currents and its properties under time reversal. It has been tested in models exactly solvable. These lectures will cover some general principles, predictions and applications, in particular phase transitions typical of non-equilibrium and thermodynamic transformations between stationary states.

September 28: Mini-course, 16:00 – 18:00
CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 1360

Giovanni Jona-Lasinio, Sapienza University of Rome

"Towards a non-equilibrium thermodynamics: macroscopic fluctuation theory" – Part II

OCTOBER 2018

Week of October 1- 5

CRM-PCTS Workshop
"Critical Phenomena in Statistical Mechanics and Quantum Field Theory"
www.crm.umontreal.ca/2018/CRMPCTS18/

Week of October 8-12

October 10: Mini-course, 16:00 – 18:00
CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 5340

Yoshiko Ogata, The University of Tokyo

"Classification of gapped Hamiltonians on quantum spin chain" – Part I

Recently, gapped ground state phases attract a lot of attention. In this talk, I would like to explain about classification of gapped Hamiltonians in quantum spin chains. Two gapped Hamiltonians are equivalent if they can be connected via a continuous path of gapped Hamiltonians. Starting from the general framework of quantum spin chains, I will talk about the known technique to prove the existence of the spectral gap. This technique play an essential role when we analyze the important example of gapped Hamiltonians, i.e., the MPS Hamiltonians. From this, we may classify some class of gapped Hamiltonians. For one dimensional systems, the split property plays an important role. I would like to explain this notion and some application to the analysis of gapped Hamiltonians.

October 11: Mini-course, 16:00 – 18:00
CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 5340

Yoshiko Ogata, The University of Tokyo

"Classification of gapped Hamiltonians on quantum spin chain" – Part II

Week of October 15-19

Workshop "Quantum Information and Quantum Statistical Mechanics"
www.crm.umontreal.ca/2018/Quantique18/

Week of October 22-26

School "Mathematics of Non-equilibrium Statistical Mechanics, on the occasion of the sixtieth birthday of Claude-Alain Pillet"
www.crm.umontreal.ca/2018/Pillet60/

October 26: Colloque des Sciences Mathématiques du Québec, 16:00 – 17:00
CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 6254

David P. Ruelle, Institut des Hautes Études Scientifiques

Week of October 29 – November 2

Workshop "Entropic Fluctuation Relations in Mathematics and Physics"
www.crm.umontreal.ca/2018/Entropic18/

NOVEMBER 2018

Week of November 12-16

November 14, 15 & 16: Aizenstatd Chair series of lectures
Svetlana Jitomirskaya (UC Irvine)
www.crm.umontreal.ca/act/theme/theme_2018_1_en/Jitomirskaya_e.php
CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 6254

Workshop "Spectral Theory of Quasi-Periodic and Random Operators"
www.crm.umontreal.ca/2018/Operateurs18/

Week of November 26-30

November 29: Series of lectures, 15:00 – 17:00
CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 5340

Raluca Balan, University of Ottawa

"Recent advances on SPDEs using the random field approach" – Part I

In a seminal article in 1944, Ito introduced the stochastic integral with respect to the Brownian motion, which turned out to be one of the most fruitful ideas in mathematics in the 20th century. This lead to the development of stochastic analysis, a field which includes the study of stochastic partial differential equations (SPDEs). One of the approaches for the study of SPDEs was initiated by Walsh (1986) and relies on the concept of random-field solution. This concept allows us to investigate the probabilistic behavior of the solution to an SPDE, simultaneously in time and space.

In these lectures, we will consider the stochastic heat equation and the stochastic wave equation on the entire space, perturbed by a Gaussian noise which is homogeneous in space (as introduced by Dalang in 1999) and is "colored" in time. This means that the noise behaves in time like a process with stationary increments, for instance the fractional Brownian motion (fBm). Since fBm is not a semi-martingale, Ito calculus techniques cannot be applied in this case. The methods that we will present are based on Malliavin calculus. Without going into technical details, the lectures will illustrate the dynamical interplay between the regularity of the noise and various properties of the solution (such as intermittency and Feyman-Kac representations).

November 30: Series of lectures, 15:00 – 17:00
CRM, Université de Montréal, Pavillon André-Aisenstadt, Room 5340

Raluca Balan, University of Ottawa

"Recent advances on SPDEs using the random field approach" – Part II