2018 - 2019
Calendrier / Calendar
MONTRÉAL

Date Heure/Time : Le vendredi 7 septembre 2018 - 16:00

Lieu/Venue : CRM, Université de Montréal, Pavillon André-Aisenstadt, salle 6254

Conférencier/Speaker : Kasia Rejzner, University of York

Titre/Title : Mathematical challenges in constructing quantum field theory models

Resume/Abstract :
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.

Date Heure/Time : Le vendredi 14 septembre 2018 - 16:00

Lieu/Venue : CRM, Université de Montréal, Pavillon André-Aisenstadt, salle 6254

Conférencier/Speaker : Sylvia Serfaty, Courant Institute, NYU

Titre/Title : Systems of points with Coulomb interactions

Resume/Abstract :
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.
**Date Heure/Time**: Le vendredi 21 septembre 2018 - 16:00

**Lieu/Venue**: UQAM, Pavillon Président-Kennedy, 201, ave du Président-Kennedy, salle PK-5115

**Conférencier/Speaker**: Ezra Miller, Duke University

**Titre/Title**: Algebraic structures for topological summaries of data

**Resume/Abstract**:
This talk introduces an algebraic framework to encode, compute, and analyze topological summaries of data. The main motivating problem, from evolutionary biology, involves statistics on a dataset comprising images of fruit fly wing veins, which amount to embedded planar graphs with varying combinatorics. Additional motivation comes from statistics more generally, the goal being to summarize unknown probability distributions from samples. The algebraic structures for topological summaries take their cue from graded polynomial rings and their modules, but the theory is complicated by the passage from integer exponent vectors to real exponent vectors. The key to making the structures practical for data science applications is a finiteness condition that encodes topological tameness -- which occurs in all modules arising from data -- robustly, in equivalent combinatorial and homological algebraic ways. Out of the tameness condition surprisingly falls much of ordinary commutative algebra, including syzygy theorems and primary decomposition.

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**Date Heure/Time**: Le vendredi 28 septembre 2018 - 16:00

**Lieu/Venue**: McGill University, Burnside Hall, salle 1104, 805 rue Sherbrooke O.

**Conférencier/Speaker**: Hans-Otto Walther, Universität Giessen

**Titre/Title**: A delay differential equation with a solution whose shortened segments are dense

**Resume/Abstract**:
Simple-looking autonomous delay differential equations $$x'(t) = f(x(t-r))$$ with a real function $f$ and single time lag $r>0$ can generate complicated (chaotic) solution behaviour, depending on the shape of $f$. The same could be shown for equations with a variable, state-dependent delay $r = d(x_t)$, even for the linear case $f(x) = -\alpha x$ with $\alpha > 0$. Here the argument $x_t$ of the delay functional $d$ is the history of the solution $x$ between $t-r$ and $t$ defined as the function $x_t :[-r,0] \to \mathbb{R}$ given by $x(t+s) = x(t+r)$ for all $s$. So the delay alone may be responsible for complicated solution behaviour. In both cases the complicated behaviour which could be established occurs in a thin dust-like invariant subset of the infinite-dimensional Banach space or manifold of functions $x :[-r,0] \to \mathbb{R}$ on which the delay equation defines a nice semiflow. The lecture presents a result which grew out of an attempt to
obtain complicated motion on a larger set with non-empty interior, as certain numerical experiments seem to suggest. For some $r>1$ we construct a delay functional $d:Y\to(0,r)$, $Y$ an infinite-dimensional subset of the space $C^\infty([-r,0],\mathbb{R})$, so that the equation $x'(t)=-\alpha x(t-d(x_t))$ has a solution whose short segments $x_t|_{[-1,0]}$, $t\geq 0$, are dense in the space $C^\infty([-1,0],\mathbb{R})$. This implies a new kind of complicated behaviour of the flowline $x\mapsto x_t$ in $C^\infty([-1,0],\mathbb{R})$. Reference: H. O. Walther, A delay differential equation with a solution whose shortened segments are dense. J. Dynamics Dif. Eqs., to appear.

Date Heure/Time : Le vendredi 5 octobre 2018 - 16:00

Lieu/Venue : CRM, Université de Montréal, Pavillon André-Aisenstadt, salle 6254

Conférencier/Speaker : Mireille Bousquet-Mélou, CNRS - Université de Bordeaux

Titre/Title : Counting lattice walks confined to cones

Resume/Abstract :
The study of lattice walks confined to cones is a very lively topic in combinatorics and in probability theory, which has witnessed rich developments in the past 20 years. In a typical problem, one is given a finite set of allowed steps $S$ in $\mathbb{Z}^d$, and a cone $C$ in $\mathbb{R}^d$. Clearly, there are $|S|^n$ walks of length $n$ that start from the origin and take their steps in $S$. But how many of them remain the the cone $C$? One of the motivations for studying such questions is that lattice walks are ubiquitous in various mathematical fields, where they encode important classes of objects: in discrete mathematics (permutations, trees, words...), in statistical physics (polymers...), in probability theory (urns, branching processes, systems of queues), among other fields. The systematic study of these counting problems started about 20 years ago. Beforehand, only sporadic cases had been solved, with the exception of walks with small steps confined to a Weyl chamber, for which a general reflection principle had been developed. Since then, several approaches have been combined to understand how the choice of the steps and of the cone influence the nature of the counting sequence $a(n)$, or of the the associated series $A(t)=\sum a(n) t^n$. For instance, if $C$ is the first quadrant of the plane and $S$ only consists of "small" steps, it is now understood when $A(t)$ is rational, algebraic, or when it satisfies a linear, or a non-linear, differential equation. Even in this simple case, the classification involves tools coming from an attractive variety of fields: algebra on formal power series, complex analysis, computer algebra, differential Galois theory, to cite just a few. And much remains to be done, for other cones and sets of steps. This talk will survey these recent developments, and conclude a series of talks by the author, in the framework of the Aisenstadt chair.

Date Heure/Time : Le vendredi 12 octobre 2018 - 16:00

Lieu/Venue : CRM, Université de Montréal, Pavillon André-Aisenstadt, salle 6254
**Conférencier/Speaker** : David Haziza, Univ. de Montréal - Lauréat 2018 du Prix CRM-SSC

**Titre/Title** : Robust estimation in the presence of influential units for skewed finite and infinite populations

**Resume/Abstract** :
Many variables encountered in practice (e.g., economic variables) have skewed distributions. The latter provide a conducive ground for the presence of influential observations, which are those that have a drastic impact on the estimates if they were to be excluded from the sample. We examine the problem of influential observations in a classical statistic setting as well as in a finite population setting that includes two main frameworks: the design-based framework and the model-based framework. Within each setting, classical estimators may be highly unstable in the presence of influential units. We propose a robust estimator of the population mean based on the concept of conditional bias of a unit, which is a measure of influence. The idea is to reduce the impact of the sample units that have a large conditional bias. The proposed estimator depends on a cut-off value. We suggest selecting the cut-off value that minimizes the maximum absolute estimated conditional bias with respect to the robust estimator. The properties of the proposed estimator will be discussed. Finally, the results of a simulation study comparing the performance of several estimators in terms of bias and mean square error will be presented.

**Date Heure/Time** : Le vendredi 19 octobre 2018 - 16:00

**Lieu/Venue** : CRM, Université de Montréal, Pavillon André-Aisenstadt, salle 1140

**Conférencier/Speaker** : Ariel Zhitnitsky, UBC - Lauréat 2018 du Prix ACP-CRM

**Titre/Title** : Vacuum Energy of the Universe and nontrivial topological sectors in Quantum Field Theory

**Resume/Abstract** :
I discuss a new scenario for early cosmology when the inflationary de Sitter phase emerges dynamically. This genuine quantum effect occurs as a result of dynamics of the topologically nontrivial sectors in a strongly coupled non-abelian gauge theory in an expanding universe. I argue that the key element for this idea to work is the presence of nontrivial holonomy in strongly coupled gauge theories. The effect is global in nature, non-analytical in coupling constant, and cannot be formulated in terms of a gradient expansion in an effective local field theory. I explain the basic ideas of this framework using a simplified 2D quantum field theory where precise computations can be carried out in theoretically controllable way. I move on to generalize the computations to 4D non-abelian gauge field theories. The last (and most important for cosmological applications) part of my talk is based on recent paper [arXiv:1709.09671].
**Date Heure/Time:** Le vendredi 26 octobre 2018 - 16:00

**Lieu/Venue:** CRM, Université de Montréal, Pavillon André-Aisenstadt, salle 6254

**Conférencier/Speaker:** David P. Ruelle, Institut des Hautes Études Scientifiques

**Titre/Title:** A generalized detailed balance relation

**Resume/Abstract:**
The transition probabilities of reactions $J \rightarrow K$ and $K \rightarrow J$ in a thermal bath are related because of the time reversal symmetry of fundamental physical laws. The relation is known as detailed balance relation. We study the problems that arise in obtaining a rigorous proof of detailed balance, using deterministic rather than Markovian dynamics. J. Englands’ biological applications of detailed balance are briefly considered.

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**Date Heure/Time:** Le vendredi 2 novembre 2018 - 16:00

**Lieu/Venue:** CRM, Université de Montréal, Pavillon André-Aisenstadt, salle 1355

**Conférencier/Speaker:** Benjamin Rossman, University of Toronto - Lauréat 2018 du Prix André-Aisenstadt

**Titre/Title:** The complexity of detecting cliques and cycles in random graphs

**Resume/Abstract:**
A strong form of the $P \neq NP$ conjecture holds that no algorithm faster than $n^{O(k)}$ solves the k-clique problem with high probability when the input is an Erdös–Rényi random graph with an appropriate edge density. Toward this conjecture, I will describe a line of work lower-bounding the average-case complexity of k-clique (and other subgraph isomorphism problems) in weak models of computation: namely, restricted classes of boolean circuits and formulas. Along the way I will discuss some of the history and current frontiers in Circuit Complexity. Joint work with Ken-ichi Kawarabayashi, Yuan Li and Alexander Razborov.

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**Date Heure/Time:** Le vendredi 9 novembre 2018 - 16:00

**Lieu/Venue:** McGill University, Burnside Hall , 805 O., rue Sherbrooke ATTENTION - SALLE 1B45 - ATTENTION

**Conférencier/Speaker:** Akshay Venkatesh, IAS

**Titre/Title:** Period mappings and Diophantine equations

**Resume/Abstract:**
I will give some friendly examples introducing the period mapping. This is an analytic
mapping which controls many aspects of how algebraic varieties change in families. After that I will explain joint work with Brian Lawrence which shows that one can exploit transcendence properties of the period mapping to prove results about Diophantine equations. For example we give another proof of the Mordell conjecture (originally proved by Faltings): there are only finitely many rational points on an algebraic curve over \( \mathbb{Q} \) whose genus is at least 2.

**Date Heure/Time**: Le vendredi 16 novembre 2018 - 16:00

**Lieu/Venue**: CRM, Université de Montréal, Pavillon André-Aisenstadt, salle 1140

**Conférencier/Speaker**: Svetlana Jitomirskaya, UC Irvine / Chaire Aisenstadt 2018

**Titre/Title**: Sharp arithmetic transitions for 1D quasiperiodic operators

**Resume/Abstract**: A very captivating question in solid state physics is to determine/understand the hierarchical structure of spectral features of operators describing 2D Bloch electrons in perpendicular magnetic fields, as related to the continued fraction expansion of the magnetic flux. In particular, the hierarchical behavior of the eigenfunctions of the almost Mathieu operators, despite significant numerical studies and even a discovery of Bethe Ansatz solutions has remained an important open challenge even at the physics level. I will present a complete solution of this problem in the exponential sense throughout the entire localization regime. Namely, I will describe the continued fraction driven hierarchy of local maxima, and a universal (also continued fraction expansion dependent) function that determines local behavior of all eigenfunctions around each maximum, thus giving a complete and precise description of the hierarchical structure. In the regime of Diophantine frequencies and phase resonances there is another universal function that governs the behavior around the local maxima, and a reflective-hierarchical structure of those, phenomena not even described in the physics literature. These results lead also to the proof of sharp arithmetic transitions between pure point and singular continuous spectrum, in both frequency and phase, as conjectured since 1994. This part of the talk is based on the papers joint with W. Liu. Within the singular continuous regime, it is natural to look for further, dimensional transitions. I will present a sharp arithmetic transition result in this regard that holds for the entire class of analytic quasiperiodic potentials, based on the joint work with S. Zhang.

**Date Heure/Time**: Le vendredi 30 novembre 2018 - 16:00

**Lieu/Venue**: McGill University, Burnside Hall , 805 O., rue Sherbrooke, salle 1104

**Conférencier/Speaker**: Marcin Sabok, McGill University

**Titre/Title**: Completeness of the isomorphism problem for separable C*-algebras
Resume/Abstract:
In logic and computer science one often studies the complexity of decision problems. In mathematical logic this leads to the program of study of relative complexity of isomorphism problems and determining various complexity classes. Broadly speaking, a problem p in a class C is complete in C if any other problem in C reduces to p. The isomorphism problem for separable C*-algebras has been studied since the 1960's and evolved into the Elliott program that classifies C*-algebras via their K-theoretic invariants. During the talk I will discuss the complexity of the isomorphism problem for separable C*-algebras and its completeness in the class of orbit equivalence relations.

Date Heure/Time: Le vendredi 7 décembre 2018 - 16:00
Lieu/Venue: UQAM, Pavillon Président-Kennedy, 201, ave du Président-Kennedy, salle PK-5115
Conférencier/Speaker: Peter Hintz, MIT

Titre/Title: Stability problems in general relativity
Resume/Abstract:
There exist several remarkable explicit solutions of Einstein's field equations of General Relativity. A fundamental problem (with implications even for experimental science) is to determine their properties upon perturbation of their initial conditions. I will describe two such solutions: Minkowski spacetime, which is a model for regions of the universe without matter or energy content; and the Kerr--de Sitter family of spacetimes describing (rotating) black holes. In recent work, in parts joint with A. Vasy, we prove global existence and obtain a precise asymptotic description of perturbations of these spacetimes. I will explain these results and indicate the role played by modern microlocal and spectral theoretic techniques in our proofs.

Date Heure/Time: Le vendredi 11 janvier 2019 - 16:00
Lieu/Venue: McGill University, Burnside Hall, 805 O., rue Sherbrooke, salle 1104
Conférencier/Speaker: Andreas Kyprianou, University of Bath

Titre/Title: The mathematics of neutron transport
Resume/Abstract:
We discuss the evolving mathematical view of the Neutron Transport Equation (NTE), which describes the flux of neutrons through inhomogeneous fissile materials. Neutron transport theory emerges in the rigorous mathematical literature in the mid-1950s. Its treatment as an integro-differential equation eventually settled in the applied mathematics literature through the theory of \( c_0 \)-semigroup theory, thanks to the work of Robert Dautray, Louis Lions and collaborators. This paved the way for its spectral analysis.
which has played an important role in the design of nuclear reactors and nuclear medical equipment. We also look at the natural probabilistic approach to the NTE which has largely been left behind. Connections with methods of branching particle systems, quasi-stationarity for Markov processes and stochastic analysis all lead new ways of characterising solutions and spectral behaviour the NTE. In particular this, in turn, leads to the suggestion of completely new Monte-Carlo algorithms, which has genuine industrial impact.

**Date Heure/Time**: Le vendredi 18 janvier 2019 - 16:00

**Lieu/Venue**: McGill University, Burnside Hall, 805 O., rue Sherbrooke, salle 1104

**Conférencier/Speaker**: Valentino Tosatti, Northwestern University

**Titre/Title**: The boundary of the Kähler cone

**Resume/Abstract**:
On any compact Kähler manifold the space of cohomology classes of all possible Kähler forms is an open convex cone inside a finite-dimensional vector space. I will discuss some recent advances in understanding the geometric and analytic properties of the classes on the boundary of this cone, and describe several applications.

**Date Heure/Time**: Le vendredi 25 janvier 2019 - 16:00

**Lieu/Venue**: CRM, Université de Montréal, Pavillon André-Aisenstadt, salle 1360

**Conférencier/Speaker**: Vadim Kaloshin, University of Maryland

**Titre/Title**: Conférence Nirenberg du CRM en analyse géométrique: Stochastic diffusive behavior at Kirkwood gaps

**Resume/Abstract**:
One of the well known indications of instability in the Solar system is the presence of Kirkwood gaps in the Asteroid belt. The gaps correspond to resonance between their periods and the period of Jupiter. The most famous ones are period ratios 3:1, 5:2, 7:3. In the 1980s, J. Wisdom and, independently, A. Neishtadt discovered one mechanism of creation for the 3:1 Kirkwood gap. We propose another mechanism of instabilities, based on an a priori chaotic underlying dynamical structure. As an indication of chaos at the Kirkwood gaps, we show that the eccentricity of Asteroids behaves like a stochastic diffusion process. Along with the famous KAM theory this shows a mixed behavior at the Kirkwood gaps: regular and stochastic. This is a joint work with M. Guardia, P. Martin and P. Roldan. (Cette conférence s'adresse à un large auditoire. / This lecture is aimed at a general mathematical audience.)
**Date Heure/Time** : Le vendredi 1 février 2019 - 16:00

**Lieu/Venue** : McGill University, Burnside Hall , 805 O., rue Sherbrooke, salle 1104

**Conférencier/Speaker** : Mina Teicher, Bar-Ilan University

**Titre/Title** : How does the brain work?

**Resume/Abstract** :
We will go over the basic challenges for understanding the human brain, the role of mathematics and three examples, one in theoretical neuroscience and two in neuro medicine.

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**Date Heure/Time** : Le vendredi 8 février 2019 - 16:00

**Lieu/Venue** : UQAM, Pavillon Président-Kennedy, 201, ave du Président-Kennedy, salle PK-5115

**Conférencier/Speaker** : Viktor Ginzburg, University of California, Santa Cruz

**Titre/Title** : Periodic orbits of Hamiltonian systems: the Conley conjecture and beyond

**Resume/Abstract** :
One distinguishing feature of Hamiltonian dynamical systems is that such systems, with very few exceptions, tend to have numerous periodic orbits and these orbits carry a lot of information about the dynamics of the system. In 1984 Conley conjectured that a Hamiltonian diffeomorphism (i.e., the time-one map of a Hamiltonian flow) of a torus has infinitely many periodic points. This conjecture was proved by Hingston some twenty years later, in 2004. Similar results for Hamiltonian diffeomorphisms of surfaces of positive genus were also established by Franks and Handel. Of course, one can expect the Conley conjecture to hold for a much broader class of closed symplectic manifolds and this is indeed the case as has been proved by Gurel, Hein and the speaker. However, the conjecture is known to fail for some, even very simple, phase spaces such as the sphere. These spaces admit Hamiltonian diffeomorphisms with finitely many periodic orbits -- the so-called pseudo-rotations -- which are of particular interest in dynamics. In this talk, mainly based on joint work with Gurel, we will discuss the role of periodic orbits in Hamiltonian dynamics and the methods used to prove their existence, and examine the situations where the Conley conjecture does not hold.

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**Date Heure/Time** : Le vendredi 15 février 2019 - 16:00

**Lieu/Venue** : McGill University, Burnside Hall , 805 O., rue Sherbrooke, salle 1104

**Conférencier/Speaker** : Fanny Kassel, CNRS, Institut des Hautes Études Scientifiques
Titre/Title: Discrete subgroups of Lie groups and geometric structures

Resume/Abstract:
Discrete subgroups of Lie groups play a fundamental role in several areas of mathematics. Discrete subgroups of SL(2,R) are well understood, and classified by the geometry of the corresponding hyperbolic surfaces. On the other hand, discrete subgroups of SL(n,R) for n>2, beyond lattices, remain quite mysterious. While lattices in this setting are rigid, there also exist more flexible "thinner" discrete subgroups, which may have large and interesting deformation spaces (some of them with topological and geometric analogies to the Teichmüller space of a surface, giving rise to so-called "higher Teichmüller theory"). We will survey recent progress in constructing and understanding such discrete subgroups from a geometric and dynamical viewpoint.

Date Heure/Time: Le vendredi 22 février 2019 - 16:00

Lieu/Venue: McGill University, Burnside Hall, 805, rue Sherbrooke O., salle 1104

Conférencier/Speaker: Sarah Harrison, McGill University

Titre/Title: Quantum Modularity in Topology in Physics

Resume/Abstract:
I will discuss a set of inter-related phenomena in topology, physics, and number theory. A natural question in topology is the construction of homological invariants of 3-manifolds. These turn out to be related to certain special 3-dimensional quantum field theories in physics. Both of these scenarios exhibit a fascinating number theoretic phenomenon: quantum modularity. Quantum modular forms, introduced by Zagier, are functions defined only at rational numbers, and in the most general cases are neither analytic nor modular. It is still an open question to develop a general theory which encompasses their behavior. I will overview these relations and discuss recent advances which may shed light on some of these questions.

Date Heure/Time: Le vendredi 1 mars 2019 - 16:00

Lieu/Venue: McGill University, Burnside Hall , 805 O., rue Sherbrooke, salle 1104

Conférencier/Speaker: Alex Lubotzky, The Hebrew University of Jerusalem

Titre/Title: ** ANNULÉ **

Resume/Abstract:
ANNULÉ
**Titre/Title**: Persistent homology as an invariant, rather than as an approximation

**Resume/Abstract**: Persistent homology is a very simple idea that was initially introduced as a way of understanding the underlying structure of an object from, perhaps noisy, samples of the object, and has been used as a tool in biology, material sciences, mapping and elsewhere. I will try to explain some of this, but perhaps also some more mathematical applications within geometric group theory. Then I'd like to pivot and study the part that traditionally has been thrown away, and show that this piece is relevant to approximation theory (a la Chebyshev), closed geodesics (a la Gromov), and to problems of quantitative topology (joint work with Ferry, Chambers, Dotter, and Manin).

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**Date Heure/Time**: Le mardi 19 mars 2019 - 14:30

**Lieu/Venue**: McGill University, Burnside Hall, 805 O., rue Sherbrooke, salle 1104

**Conférencier/Speaker**: Andrew Marks, UCLA

**Titre/Title**: Special Colloquium: A constructive solution to Tarski’s circle squaring problem

**Resume/Abstract**: In 1925, Tarski posed the problem of whether a disc in $\mathbb{R}^2$ can be partitioned into finitely many pieces which can be rearranged by isometries to form a square of the same area. Unlike the Banach-Tarski paradox in $\mathbb{R}^3$, it can be shown that two Lebesgue measurable sets in $\mathbb{R}^2$ cannot be equidecomposed by isometries unless they have the same measure. Hence, the disk and square must necessarily be of the same area. In 1990, Laczkovich showed that Tarski’s circle squaring problem has a positive answer using the axiom of choice. We give a completely constructive solution to the problem and describe an explicit (Borel) way to equidecompose a circle and a square. This answers a question of Wagon. Our proof has three main ingredients. The first is work of Laczkovich in Diophantine approximation. The second is recent progress in a research program in descriptive set theory to understand how the complexity of a countable group is related to the complexity of the equivalence relations generated by its Borel actions. The third ingredient is ideas coming from the study of flows in networks. This is joint work with Spencer Unger.
Date Heure/Time : Le vendredi 22 mars 2019 - 16:00

Lieu/Venue : UQAM, Pavillon Président-Kennedy, 201, ave du Président-Kennedy, salle PK-5115

Conférencier/Speaker : Emmy Murphy, Northwestern University

Titre/Title : Flexibility in contact and symplectic geometry

Resume/Abstract :
We discuss a number of h-principle phenomena which were recently discovered in the field of contact and symplectic geometry. In generality, an h-principle is a method for constructing global solutions to underdetermined PDEs on manifolds by systematically localizing boundary conditions. In symplectic and contact geometry, these strategies typically are well suited for general constructions and partial classifications. Some of the results we discuss are the characterization of smooth manifolds admitting contact structures, high dimensional overtwistedness, the symplectic classification of flexible Stein manifolds, and the construction of exotic Lagrangians in $\mathbb{C}^n$.

Date Heure/Time : Le vendredi 29 mars 2019 - 16:00

Lieu/Venue : McGill University, Burnside Hall, 805 O., rue Sherbrooke, salle 1104

Conférencier/Speaker : Minhyong Kim, University of Oxford

Titre/Title : Principal Bundles in Diophantine Geometry

Resume/Abstract :
Principal bundles and their moduli have been important in various aspects of physics and geometry for many decades. It is perhaps not so well-known that a substantial portion of the original motivation for studying them came from number theory, namely the study of Diophantine equations. I will describe a bit of this history and some recent developments.

Date Heure/Time : Le vendredi 12 avril 2019 - 16:00

Lieu/Venue : McGill University, Burnside Hall, 805 O., rue Sherbrooke, salle 1104

Conférencier/Speaker : Nicolas Bergeron, Institut de Mathématiques de Jussieu - Paris Rive Gauche

Titre/Title : Linking in torus bundles and Hecke L functions

Resume/Abstract :
Torus bundles over the circle are among the simplest and cutest examples of 3-dimensional manifolds. After presenting some of these examples, using in particular
animations realized by Jos Leys, I will consider periodic orbits in these fiber bundles over the circle. We will see that their linking numbers --- that are rational numbers by definition --- can be computed as certain special values of Hecke L-functions. Properly generalized this viewpoint makes it possible to give new topological proof of now classical rationality or integrality theorems of Klingen-Siegel and Deligne-Ribet. It also leads to interesting new "arithmetic lifts" that I will briefly explain. All this is extracted from an on going joint work with Pierre Charollois, Luis Garcia and Akshay Venkatesh.

Date Heure/Time : Le vendredi 26 avril 2019 - 16:00
Lieu/Venue : McGill University, Burnside Hall, 805 O., rue Sherbrooke, salle 1104
Conférencier/Speaker : Alan W. Reid, Rice University
Titre/Title : Distinghishing finitely presented groups by their finite quotients
Resume/Abstract :
If G is a finitely generated group, let C(G) denote the set of finite quotients of G. This talk will survey work on the question of to what extent C(G) determines G up to isomorphism, culminating in a discussion of examples of Fuchsian and Kleinian groups that are determined by C(G) (amongst finitely generated residually finite groups).

Date Heure/Time : Le vendredi 3 mai 2019 - 16:00
Lieu/Venue : McGill University, Burnside Hall, 805 O., rue Sherbrooke, salle 1104
Conférencier/Speaker : Lenya Ryzhik, Stanford University
Titre/Title : The stochastic heat equation and KPZ in dimensions three and higher
Resume/Abstract :
The stochastic heat equation and the KPZ equation appear as the macroscopic limits for a large class of probabilistic models, and the study of KPZ, in particular, led to many fascinating developments in probability over the last decade or so, from the regularity structures to integrable probability. We will discuss a small group of recent results on these equations in simple settings, of the PDE flavour, that fall in line with what one may call naive expectations by an applied mathematician.

Date Heure/Time : Le vendredi 10 mai 2019 - 16:00
Lieu/Venue : McGill University, Burnside Hall, 805 O., rue Sherbrooke, salle 1104
Conférencier/Speaker : Amanda Folsom, Amherst College
**Titre/Title**: Quantum Jacobi forms and applications

**Resume/Abstract**: Quantum modular forms were defined in 2010 by Zagier; they are somewhat analogous to ordinary modular forms, but they are defined on the rational numbers as opposed to the upper half complex plane, and have modified transformation properties. In 2016, Bringmann and the author defined the notion of a quantum Jacobi form, naturally marrying the concept of a quantum modular form with that of a Jacobi form (the theory of which was developed by Eichler and Zagier in the 1980s). We will discuss these intertwined topics, emphasizing recent developments and applications. In particular, we will discuss applications to combinatorics, topology (torus knots), and representation theory (VOAs).

**Date Heure/Time**: Le jeudi 16 mai 2019 - 16:00

**Lieu/Venue**: UQAM, Pavillon Président-Kennedy, 201, ave du Président-Kennedy, salle PK-5115

**Conférencier/Speaker**: Jungkai A. Chen, National Taiwan University

**Titre/Title**: Introduction to birational classification theory in dimension three and higher

**Resume/Abstract**: One of the main themes of algebraic geometry is to classify algebraic varieties and to study various geometric properties of each of the interesting classes. Classical theories of curves and surfaces give a beautiful framework of classification theory. Recent developments provide more details in the case of dimension three. We are going to introduce the three-dimensional story and share some expectations for even higher dimensions.