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List of Abbreviations
Liste des abbréviations

Alg	Algebra Algèbre
AlgGeo	Algebraic Geometry and Singularity Theory Géométrie algébrique et théorie des singularités
Analys	Analysis Analyse
CombGr	Combinatorics and Graph Theory Combinatoire et théorie des graphes
DiffGeo	Differential Geometry Géométie differentielle
DynSys	Dynamical Systems Systèmes dynamiques
Optim	Optimization and Approximation Optimisation et approximation
PDE	Partial Differential Equations Equations aux dérivées partielles
Plenary	Plenary Lectures Conférences plénères
Prob	Probability Probabilité
Top	Topology Topologie

Schedule for Social/Other Activities
Horaire pour Activités sociales

Wednesday August 12	**mercredi 12 août**
16:00 - 18:00	Registration / Inscription, Marine Drive Residence

Thursday August 13	**jeudi 13 août**
8:30 - 16:00	Registration / Inscription, Forest Sciences Centre Atrium
9:00 - 9:30	Opening Address / Ouverture, FSC-1005
10:30 - 11:00	Break / Pause
15:30 - 15:45	Break / Pause
17:00 - 18:00	Reception / Réception, Forest Sciences Centre Atrium

Friday August 14	**vendredi 14 août**
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10:30 - 11:00	Break / Pause
15:00 - 15:15	Break / Pause
19:00 - 22:00	Banquet, Sage Bistro

Saturday August 15	**samedi 15 août**
8:30 - 13:30	Registration / Inscription, Forest Sciences Centre Atrium
10:30 - 11:00	Break / Pause
16:00 - 16:15	Closing / Mot de la fin, FSC-1005

Schedule
Horaire

Wednesday August 12 — mercredi 12 août

16:00 - 18:00	Registration / Inscription, Marine Drive Residence

Thursday August 13 — jeudi 13 août

8:30 - 16:00	Registration / Inscription, Forest Sciences Centre Atrium
9:00 - 9:30	Opening Address / Ouverture, FSC-1005
9:30 - 10:30	Jose Seade, Plenary, FSC-1005, *Foliations with Bott-Morse Singularities*
10:30 - 11:00	Break / Pause
11:00 - 11:25	Alejandro Adem, Top, FSC-1222
11:00 - 11:25	Leticia Brambila, AlgGeo, FSC-1002
11:00 - 11:25	Jorge Garcia, Prob, FSC 1221
11:00 - 11:25	Petr Lisonek, CombGr, FSC-1220
11:00 - 11:25	Ray McLenaghan, DynSys, FSC-1613
11:00 - 11:25	Catherine Searle, DiffGeo, FSC-1615
11:00 - 11:40	Jose Antonio de la Peña, Alg, FSC-1611
11:00 - 11:50	Akos Magyar, Analys, FSC-1003
11:30 - 11:55	Jim Bryan, AlgGeo, FSC-1002
11:30 - 11:55	Rafael G. Campos, Optim, FSC-1001
11:30 - 11:55	Antonio Garcia, DynSys, FSC-1613
11:30 - 11:55	Liviu Mare, Top, FSC-1222
11:30 - 11:55	Miguel Pizaña, CombGr, FSC-1220
11:30 - 11:55	Deniz Sezer, Prob, FSC 1221
11:30 - 11:55	McKenzie Wang, DiffGeo, FSC-1615
11:45 - 12:25	Diana Avella, Alg, FSC-1611
12:00 - 12:25	Abel Castorena, AlgGeo, FSC-1002
12:00 - 12:25	Joaquin Delgado, DynSys, FSC-1613
12:00 - 12:25	Magali Folch, Analys, FSC-1003
12:00 - 12:25	Jesus Gonzalez, Top, FSC-1222
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12:00 - 12:25	Paco Larrión, CombGr, FSC-1220
12:00 - 12:25	Olaf Muller, DiffGeo, FSC-1615
12:00 - 12:25	John Walsh, Prob, FSC 1221
12:30 - 12:55	Christof Geiss, Alg, FSC-1611
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14:00 - 14:25	Monica Cojocaru, DynSys, FSC-1613
14:00 - 14:25	Olivier Collin, Top, FSC-1222
14:00 - 14:25	David Costa, PDE, FSC-1005
14:00 - 14:25	Begoñia Fernández, Prob, FSC 1221
14:00 - 14:25	Ailana Fraser, DiffGeo, FSC-1615
14:00 - 14:25	Michael Friedlander, Optim, FSC-1001
14:00 - 14:25	Chris Godsil, CombGr, FSC-1220
14:00 - 14:25	Mahta Khosravi, Analys, FSC-1003
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14:30 - 14:55	Gabriela Araujo, CombGr, FSC-1220
14:30 - 14:55	Aubin Arroyo, DynSys, FSC-1613
14:30 - 14:55	Gabriel Ruiz Hernandez, DiffGeo, FSC-1615
14:30 - 14:55	Daniel Hernández-Hernández, Prob, FSC 1221

14:30 - 14:55	Emilio Marmolejo, Analys, FSC-1003
14:30 - 14:55	Eduardo Martinez-Pedroza, Top, FSC-1222
14:30 - 14:55	Amir Moradifam, PDE, FSC-1005
14:30 - 14:55	Adriana Ortiz, AlgGeo, FSC-1002
14:30 - 14:55	Jane Ye, Optim, FSC-1001
14:45 - 15:25	Pedro Luis del Angel, Alg, FSC-1611
15:00 - 15:25	Benoit Charbonneau, DiffGeo, FSC-1615
15:00 - 15:25	Galia Dafni, Analys, FSC-1003
15:00 - 15:25	Carlos García-Azpeitia, PDE, FSC-1005
15:00 - 15:25	Kiumars Kaveh, AlgGeo, FSC-1002
15:00 - 15:25	Joy Morris, CombGr, FSC-1220
15:00 - 15:25	Dominique P. Orban, Optim, FSC-1001
15:00 - 15:25	Ernesto Pérez-Chavela, DynSys, FSC-1613
15:00 - 15:25	Daniel Juan Pineda, Top, FSC-1222
15:30 - 15:45	Break / Pause
15:45 - 16:45	Rachel Kuske, Plenary, FSC-1005, *Noise-driven order via multiple scales*
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9:00 - 9:25	Federico Sánchez Bringas, DiffGeo, FSC-1615
9:00 - 9:25	Ryan Budney, Top, FSC-1222
9:00 - 9:25	Julio César García-Corte, Prob, FSC 1221
9:00 - 9:25	Mike Newman, CombGr, FSC-1220
9:00 - 9:25	Michael L. Overton, Optim, FSC-1001
9:00 - 9:25	Jorge Rivera-Noriega, Analys, FSC-1003
9:00 - 9:25	Jose Seade, AlgGeo, FSC-1002
9:00 - 9:25	Carlos Villegas, DynSys, FSC-1613
9:00 - 9:40	Jochen Kuttler, Alg, FSC-1611
9:30 - 9:55	Lennard Bakker, DynSys, FSC-1613
9:30 - 9:55	Victor Castellanos, AlgGeo, FSC-1002
9:30 - 9:55	Haydeé Herrera-Guzmán, DiffGeo, FSC-1615
9:30 - 9:55	Ernesto Lupercio, Top, FSC-1222
9:30 - 9:55	Jan Modersitzki, Optim, FSC-1001
9:30 - 9:55	Christine Soteros, Prob, FSC 1221
9:30 - 9:55	Ricardo Strausz, CombGr, FSC-1220
9:30 - 9:55	Carlos Vélez, PDE, FSC-1005
9:30 - 9:55	Ping Zhou, Analys, FSC-1003
9:45 - 10:25	Nicolas Guay, Alg, FSC-1611
10:00 - 10:25	Janusz Adamus, AlgGeo, FSC-1002
10:00 - 10:25	Rick Jardine, Top, FSC-1222
10:00 - 10:25	Spiro Karigiannis, DiffGeo, FSC-1615
10:00 - 10:25	Robert Masson, Prob, FSC 1221
10:00 - 10:25	Sean McGuinness, CombGr, FSC-1220
10:00 - 10:25	Lino Reséndiz, Analys, FSC-1003
10:00 - 10:25	Manuele Santoprete, DynSys, FSC-1613
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10:30 - 11:00	Break / Pause

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13:30 - 13:55	Bertrand Guenin, CombGr, FSC-1220
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13:30 - 13:55	Dale Rolfsen, Top, FSC-1222
13:30 - 13:55	Cristina Stoica, DynSys, FSC-1613
13:30 - 13:55	Hong Yue, Analys, FSC-1003
13:30 - 14:10	Michael Lau, Alg, FSC-1611
14:00 - 14:25	Patrick Brosnan, AlgGeo, FSC-1002
14:00 - 14:25	Craig Cowan, PDE, FSC-1005
14:00 - 14:25	Mario Eudave, Top, FSC-1222
14:00 - 14:25	Martha Guzmán-Partida, Analys, FSC-1003
14:00 - 14:25	Alexander Holroyd, Prob, FSC 1221
14:00 - 14:25	Andrés Pedroza, DiffGeo, FSC-1615
14:00 - 14:25	Eduardo Rivera, CombGr, FSC-1220
14:00 - 14:25	Alberto Verjovsky, DynSys, FSC-1613
14:30 - 14:55	Antonio Capella-Kort, PDE, FSC-1005
14:30 - 14:55	Jose Luis Cisneros, AlgGeo, FSC-1002
14:30 - 14:55	Brian Cook, Analys, FSC-1003
14:30 - 14:55	Florin Diacu, DynSys, FSC-1613
14:30 - 14:55	Onésimo Hernández-Lerma, Prob, FSC 1221
14:30 - 14:55	Tom Ivey, DiffGeo, FSC-1615
14:30 - 14:55	Martín Manrique, CombGr, FSC-1220
14:30 - 14:55	Peter Zvengrowski, Top, FSC-1222
14:45 - 15:25	Erhard Neher, Alg, FSC-1611
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15:15 - 16:15	Niky Kamran, Plenary, FSC-1005, *Wave equations in Kerr geometry*
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9:00 - 9:25	Martin Barlow, Prob, FSC 1221
9:00 - 9:25	Francisco J. Gonzalez-Acuña, Top, FSC-1222
9:00 - 9:25	Adolfo Guillot, DynSys, FSC-1613
9:00 - 9:25	Pavol Hell, CombGr, FSC-1220
9:00 - 9:25	Jacques Hurtubise, AlgGeo, FSC-1002
9:00 - 9:25	Hugues Lapointe, DiffGeo, FSC-1615
9:00 - 9:25	José Luis Martínez-Morales, Optim, FSC-1001
9:00 - 9:25	Panayotis Panayotaros, PDE, FSC-1005
9:00 - 9:40	Alfredo Nájera, Alg, FSC-1611
9:00 - 9:50	Mónica Clapp, Analys, FSC-1003
9:30 - 9:55	Caroline Adlam, DynSys, FSC-1613
9:30 - 9:55	Hortensia Galeana, CombGr, FSC-1220
9:30 - 9:55	Alip Mohammed, PDE, FSC-1005
9:30 - 9:55	Ruxandra Moraru, AlgGeo, FSC-1002
9:30 - 9:55	Jeremy Quastel, Prob, FSC 1221
9:30 - 9:55	Javier F. Rosenblueth, Optim, FSC-1001

9:30 - 9:55	Donald Stanley, Top, FSC-1222
9:30 - 9:55	Gregor Weingart, DiffGeo, FSC-1615
9:45 - 10:25	Yun Gao, Alg, FSC-1611
10:00 - 10:25	Martin Celli, DynSys, FSC-1613
10:00 - 10:25	Isidoro Gitler, CombGr, FSC-1220
10:00 - 10:25	Kathryn Hare, Analys, FSC-1003
10:00 - 10:25	Andy Nicas, Top, FSC-1222
10:00 - 10:25	Ibrahim Slim, PDE, FSC-1005
10:00 - 10:25	Luis Verde-Star, Optim, FSC-1001
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13:30 - 13:55	Heinz Bauschke, Optim, FSC-1001
13:30 - 13:55	Pedro Luis del Angel, AlgGeo, FSC-1002
13:30 - 13:55	Sam Gitler, Top, FSC-1222
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13:30 - 13:55	Marcos López, Analys, FSC-1003
13:30 - 13:55	Gabriel López-Garza, PDE, FSC-1005
13:30 - 13:55	Bojan Mohar, CombGr, FSC-1220
13:30 - 14:10	Clifton Cunningham, Alg, FSC-1611
14:00 - 14:25	Jim Bryan, Top, FSC-1222
14:00 - 14:25	Marco Gualtieri, AlgGeo, FSC-1002
14:00 - 14:25	Andrew King, CombGr, FSC-1220
14:00 - 14:25	Abbas Momeni, PDE, FSC-1005
14:00 - 14:25	Michael Saunders, Optim, FSC-1001
14:00 - 14:25	Leandro Zuberman, Analys, FSC-1003
14:15 - 14:55	Fernando Szechtman, Alg, FSC-1611
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14:30 - 14:55	Yuriy Zinchenko, Optim, FSC-1001
15:00 - 16:00	Alberto Verjovsky, Plenary, FSC-1005, *Wild knots in higher dimensions as limit sets of Kleinian groups*
16:00 - 16:15	Closing / Mot de la fin, FSC-1005

Plenary Lectures
Conférences plénères

Schedule/Horaire **Room/Salle: FSC-1005**

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9:30 - 10:30	Jose Seade, *Foliations with Bott-Morse Singularities*
15:45 - 16:45	Rachel Kuske, *Noise-driven order via multiple scales*

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11:00 - 12:00	Onésimo Hernández-Lerma, *Topics on Dynamic Games*
15:15 - 16:15	Niky Kamran, *Wave equations in Kerr geometry*

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11:00 - 12:00	James Arthur, *What the proof of the Fundamental Lemma gives us*
15:00 - 16:00	Alberto Verjovsky, *Wild knots in higher dimensions as limit sets of Kleinian groups*

Abstracts/Résumés

JAMES ARTHUR, University of Toronto
[Saturday August 15 / samedi le 15 août, 11:00 – FSC-1005]
What the proof of the Fundamental Lemma gives us

The recent proof of the Fundamental Lemma by Ngo Bau Chau is a breakthrough in the theory of automorphic forms and the Langlands programme. It is the culmination of work carried out by a number of mathematicians over the past thirty years. We shall try to motivate the origins of the problem in the trace formula, and to say something of the history of its proof. We shall then describe how its resolution opens the way for progress on the representations of classical groups, the theory of Shimura varieties, and the principle of functoriality.

ONÉSIMO HERNÁNDEZ-LERMA, Mathematics Department, CINVESTAV-IPN, A. Postal 14-740, Mexico, D.F. 07000, Mexico
[Friday August 14 / vendredi le 14 août, 11:00 – FSC-1005]
Topics on Dynamic Games

A game is a mathematical model of conflict or bargaining between rational decision-makers. Game theory is a very active field of research partly because of its intrinsic mathematical beauty, and partly because it has proven to be very useful to understand situations of conflict and cooperation in economics, engineering, ecology, and many other areas. This talk is about dynamic games, that is, games in which the state behaves as a discrete or continuous time, possibly stochastic, dynamical system. We survey results on both cooperative and noncooperative games, and some important special cases such as compromise solutions, bargaining games, zero-sum games, and games against nature, also known as minimax or worst-case control problems.

NIKY KAMRAN, McGill University, Department of Mathematics and Statistics
[Friday August 14 / vendredi le 14 août, 15:15 – FSC-1005]
Wave equations in Kerr geometry

The Kerr metric is a two-parameter family of solutions of the Einstein vacuum field equations which describes the outer space-time geometry of a rotating black hole in equilibrium. Its importance in General Relativity stems from the black hole uniqueness

theorems of Israel and Carter which characterize it as the unique set of solutions to the boundary value problem corresponding to black hole equilibrium states. The geometric properties of the Kerr metric have been described by Chandrasekhar as "having the aura of the miraculous", and have opened the door to the study from a rigorous mathematical perspective the long time dynamics of waves in Kerr geometry, as well as the phenomenon of super-radiance. I will review some of the results obtained on these questions in collaboration with Felix Finster, Joel Smoller and Shing-Tung Yau, and I will also indicate a number of open problems and perspectives.

RACHEL KUSKE, UBC
[Thursday August 13 / jeudi le 13 août, 15:45 – FSC-1005]
Noise-driven order via multiple scales

Transient or unstable behavior is often ignored in considering long time dynamics in the deterministic world. However, stochastic effects can change the picture dramatically, so that apparently stabilized transients can dominate the long range behavior. This talk will show how this theme appears in seemingly unrelated different applications, including delay-driven vibrations and infectious disease. Some canonical models are compared, illustrating how hidden time scales play an important role in noise-driven regular behavior, such as coherent oscillations, synchronization, and even quiescence. Different perspectives on coherence resonance show that the order in these models can be attributed to transients "stabilized" by stochastic effects, suggesting a new analysis on reduced models to better understand and predict these phenomena.

JOSE SEADE, UNAM-Cuernavaca
[Thursday August 13 / jeudi le 13 août, 9:30 – FSC-1005]
Foliations with Bott-Morse Singularities

This talk will be about joint work with Bruno Scardua (Brazil) on codimension one foliations on oriented smooth manifolds having a singular locus where the foliation is locally defined by a Bott-Morse function. Examples of such foliations arise, for instance, by considering the fibers of a Morse function f on a smooth manifold M and their liftings to manifolds which are fiber bundles over M. Another class of examples of such foliations arises by looking at cohomogeneity 1 actions of compact Lie groups on smooth manifolds having exceptional orbits. There are many other ways how foliations with Bott-Morse singularities arise.

We show how the classical theory for non-singular foliations, such as Reeb's stability theorems, extends to singular foliations of this type. In the particular case when all the singularities are transversally centers, our stability theorem yields to a topological characterization of all such foliations. We thus get a theorem that unifies the classical theorem of Reeb, that a manifold with a Morse foliation with only center-type singularities must be the sphere, and the well-known theorem that a cohomogeneity 1 action of a compact Lie group having exceptional orbits has exactly two such orbits and the orbit space is the interval.

We also prove a stability theorem for Bott-Morse foliations with saddle-singularities and various topological consequences of it.

ALBERTO VERJOVSKY, Instituto de Matemáticas, Unidad Cuernavaca, Universidad Nacional Autónoma de México
[Saturday August 15 / samedi le 15 août, 15:00 – FSC-1005]
Wild knots in higher dimensions as limit sets of Kleinian groups

In this talk we describe how to construct infinitely many wild knots, $S^n \to S^{n+2}$, for $n = 2, 3, 4$ and 5, each of which is a limit set of a geometrically finite Kleinian group Γ acting conformally on S^{n+2}. We also describe some of their properties.

Algebra
Algèbre

Org: Christof Geiss (UNAM) and/et **Arturo Pianzola** (Alberta)

Schedule/Horaire **Room/Salle: FSC-1611**

Thursday August 13 — jeudi 13 août

11:00 - 11:40	Jose Antonio de la Peña, *The information in the coefficients of a Coxeter polynomial*
11:45 - 12:25	Diana Avella, *Combinatorial approach to the derived classification of gentle algebras*
12:30 - 12:55	Christof Geiss, *Tubular Cluster Algebras*
14:00 - 14:40	Julia Gordon, *Motivic Integration and local integrability of characters*
14:45 - 15:25	Pedro Luis del Angel, *Motives of Grassmannian Bundles*

Friday August 14 — vendredi 14 août

9:00 - 9:40	Jochen Kuttler
9:45 - 10:25	Nicolas Guay, *Representations of double affine Lie algebras*
13:30 - 14:10	Michael Lau, *Representations of Multiloop Algebras*
14:45 - 15:25	Erhard Neher, *Finite-dimensional irreducible representations of equivariant map algebras*

Saturday August 15 — samedi 15 août

9:00 - 9:40	Alfredo Nájera, *Coefficients dynamics of the Markov cluster algebra*
9:45 - 10:25	Yun Gao, *Lie triple systems and Steinberg unitary Lie algebras*
13:30 - 14:10	Clifton Cunningham, *Character sheaves over local fields: the example* $\mathrm{SL}(2)$
14:15 - 14:55	Fernando Szechtman, *Modular reduction of the Steinberg representation of the general linear group*

Abstracts/Résumés

DIANA AVELLA, UNAM, Av Universidad 3000, Coyoacan, Mexico
[Thursday August 13 / jeudi le 13 août, 11:45 – FSC-1611]
Combinatorial approach to the derived classification of gentle algebras

An interesting family in representation theory is the one consisting of gentle algebras. This family is closed under derived equivalence by a result of Schröer and Zimmermann; because of the way in which these algebras are defined they can be described and manipulated in a very easy combinatorial way, in order to understand their derived equivalence classes. We will discuss the results obtained for gentle algebras of two cycles and some generalizations for gentle algebras with more than two cycles, by using this combinatorial approach.

CLIFTON CUNNINGHAM, University of Calgary
[Saturday August 15 / samedi le 15 août, 13:30 – FSC-1611]
Character sheaves over local fields: the example $\mathrm{SL}(2)$

Although character sheaves were devised with representations of finite groups of Lie type in mind, character sheaves are perfectly well defined for reductive algebraic groups over any algebraically closed field. Nevertheless, the relation between character sheaves of an algebraic group G over an algebraic closure of a field K and characters of representations of $G(K)$ is well understood only when K is a finite field and when K is the field of complex numbers.

In joint work with Hadi Salmasian, we consider the case when K is a non-Archimedean local field and explain how to match certain character sheaves of an unramified connected reductive algebraic group G with virtual representations of $G(K)$. In this

talk I will illustrate this connection by treating the example $G = \mathrm{SL}(2)$ over the p-adic field $K = \mathbb{Q}_p$. In the process we will see lovely relations between certain character sheaves of $\mathrm{SL}(2)$ over $\bar{\mathbb{Q}}_p$ and L-packets of admissible representations of $\mathrm{SL}(2, \mathbb{Q}_p)$. Joint work with Hadi Salmasian.

JOSE ANTONIO DE LA PEÑA, Universidad Nacional Autónoma de México
[Thursday August 13 / jeudi le 13 août, 11:00 – FSC-1611]
The information in the coefficients of a Coxeter polynomial

Let A be a finite dimensional algebra over an algebraically closed field, assume that A has finite global dimension. Let $p(t) = a_0 + a_1 t + a_2 t^2 + \cdots + a_n t^n$ be the Coxeter polynomial of A. If A is connected then $a_0 = 1 = a_n$, and Happel has shown that a_1 is the alternating sum of the dimension of the Hochschild cohomology groups of A. We build a large family of algebras where $a_2 = 1$ happens exactly when A is derived equivalent to a hereditary algebra of type A_n.

PEDRO LUIS DEL ANGEL, Centro de Investigacion en Matematicas A.C.
[Thursday August 13 / jeudi le 13 août, 14:45 – FSC-1611]
Motives of Grassmannian Bundles

We will briefly recall some properties which are common to several cohomological theories when applied to smooth projective varieties, to motivate Grothendieck's search for a theory of motives. Then we will recall the definition of chow groups of a smooth projective variety and the definition of Chow Motives, with some explicit and simple examples, in particular we will work out the motive of a projective bundle and then will say what the motive of a Grassmannian Bundle should be.

Some of the results in this talk were obtained by my student Carlos Pompeyo in his Ph.D. thesis.

YUN GAO, York
[Saturday August 15 / samedi le 15 août, 9:45 – FSC-1611]
Lie triple systems and Steinberg unitary Lie algebras

Steinberg unitary Lie algebras were introduced by Allison and Faulkner. They gave a necessary and sufficient condition for the coordinate algebras being n-faithful for $n > 2$. In this talk, we will use Lie triple systems to give a necessary and sufficient condition for $n = 2$ case. We will also work out the central extensions when the coordinate algebra is eu_2 Lie admissible by using the Lie triple systems.

CHRISTOF GEISS, Instituto de Matematicas, UNAM, Ciudad Universitaria, 04510 Mexico D.F., Mexico
[Thursday August 13 / jeudi le 13 août, 12:30 – FSC-1611]
Tubular Cluster Algebras

We present a categorification of four mutation finite cluster algebras by the cluster category of the category of coherent sheaves over a weighted projective line of tubular weight type. Each of these cluster algebras which we call tubular is associated to an elliptic root system. We show that via a cluster character the cluster variables are in bijection with the positive real Schur roots associated to the weighted projective line. In one of the four cases this is achieved by the approach to cluster algebras of Fomin–Shapiro–Thurston using a 2-sphere with 4 marked points whereas in the remaining cases it is done by the approach of Geiss–Leclerc–Schroer using preprojective algebras.

JULIA GORDON, University of British Columbia
[Thursday August 13 / jeudi le 13 août, 14:00 – FSC-1611]
Motivic Integration and local integrability of characters

Algebra
Algèbre

Let K be a local field, G a reductive group over K, and π a representation of G. A theorem due to Harish-Chandra asserts that there is a locally constant function defined on the set of regular elements in G, which is also locally in L^1, that represents the distribution character of π. This function is commonly referred to as the character of π. Harish-Chandra's theorem assumes that K has characteristic zero. In positive characteristic, it is known that the character function exists and is locally constant, but it is not known whether it is locally integrable. We show that for a large class of representations of symplectic and special orthogonal groups, the character is in a class of functions called "constructible motivic exponential functions"; this class is defined by means of logic.

As an application, for these representations we can conclude that the character is a locally L^1 even if K is of positive characteristic, as long as the residue characteristic is large.

This is joint work with Raf Cluckers, Clifton Cunningham, and Loren Spice.

NICOLAS GUAY, University of Alberta, Edmonton, AB, Canada
[Friday August 14 / vendredi le 14 août, 9:45 – FSC-1611]
Representations of double affine Lie algebras

After introducing Lie algebras attached to a rank one rational Cherednik algebra, I will present results related to three kinds of representations of such algebras: integrable highest weight modules, Weyl modules and quasi-finite highest weight modules. In the first and third cases, I will present a criterion for integrability and quasi-finiteness, whereas, in the second case, I will give lower bounds for the dimension of certain Weyl modules.

JOCHEN KUTTLER, Alberta
[Friday August 14 / vendredi le 14 août, 9:00 – FSC-1611]

MICHAEL LAU, University of Windsor
[Friday August 14 / vendredi le 14 août, 13:30 – FSC-1611]
Representations of Multiloop Algebras

Given any complex Lie algebra L, the current algebra $\mathrm{Map}(T, L)$ of L-valued regular functions on the n-torus T is a Lie algebra with pointwise Lie bracket. When T and L admit the action of a discrete group G, the G-equivariant functions in $\mathrm{Map}(T, L)$ form a Lie subalgebra. We will discuss some examples of such algebras and their representations.

ALFREDO NÁJERA, Universidad Nacional Autónoma de México, Av. Universidad, 3000 México D.F.
[Saturday August 15 / samedi le 15 août, 9:00 – FSC-1611]
Coefficients dynamics of the Markov cluster algebra

We study the cluster algebra with principal coefficients arising from the torus with one puncture, which sometimes is called the Markov cluster algebra. We describe the coefficients in terms of triples of rational numbers which parametrize the exchange matrices.

ERHARD NEHER, University of Ottawa
[Friday August 14 / vendredi le 14 août, 14:45 – FSC-1611]
Finite-dimensional irreducible representations of equivariant map algebras

Consider an affine algebraic variety X and a finite-dimensional simple Lie algebra L, both equipped with an action of a finite group by automorphisms and both defined over an algebraically closed field of characteristic 0. The equivariant map algebra

associated to these data is the Lie algebra consisting of the equivariant maps from X to L. Examples of equivariant map algebras are (twisted or untwisted) multiloop algebras, current algebras, n-point Lie algebras, and the Onsager (Lie) algebra.

In this talk I will describe finite-dimensional irreducible representations of equivariant map algebras.

The talk is based on joint work with Alistair Savage and Prasad Senesi.

FERNANDO SZECHTMAN, University of Regina

[Saturday August 15 / samedi le 15 août, 14:15 – FSC-1611]

Modular reduction of the Steinberg representation of the general linear group

Shortly after Chevalley constructed his groups of Lie type in a uniform manner, Steinberg did the same for his representation. In characteristic 0 it is always irreducible and realizable over $\mathbb{Z}$. Reduction modulo a prime different from the defining characteristic need no longer be irreducible and, in fact, may be quite far from being so.

In the present talk we will examine the case of the general linear group $\mathrm{GL}_n(q)$ with the aim of finding of finding a composition series for St when reduced modulo a prime ℓ that does not divide q.

It is conjectured that a natural filtration for this reduction, namely its Jantzen's filtration, is actually a composition series. Our presentation will focus on recent progress regarding this conjecture.

Algebraic Geometry and Singularity Theory
Géométrie algébrique et théorie des singularités

Org: Ed Bierstone (Toronto), **Leticia Brambila** (CIMAT), **Jacques Hurtubise** (McGill) and/et **Jose Seade** (UNAM)

Schedule/Horaire **Room/Salle: FSC-1002**

Thursday August 13 — jeudi 13 août

11:00 - 11:25	Leticia Brambila, *Moduli of coherent systems*
11:30 - 11:55	Jim Bryan, *The Donaldson–Thomas and Gromov–Witten theory of orbifolds and their resolutions*
12:00 - 12:25	Abel Castorena, *A family of curves in the Severi variety with special moduli*
14:00 - 14:25	Edward Bierstone, *Resolution except for minimal singularities*
14:30 - 14:55	Adriana Ortiz, *A formula for the Hessian curve and Cusps of Gauss of a real polynomial*
15:00 - 15:25	Kiumars Kaveh, *Convex bodies for actions of reductive groups*

Friday August 14 — vendredi 14 août

9:00 - 9:25	Jose Seade, *On the Chern classes of singular varities*
9:30 - 9:55	Victor Castellanos, *A Singular computation of the Poincaré–Hopf index of real-analytic vector fields*
10:00 - 10:25	Janusz Adamus, *Geometric Auslander criterion for flatness*
14:00 - 14:25	Patrick Brosnan, *Essential dimension for moduli stacks*
14:30 - 14:55	Jose Luis Cisneros, *Refinements of Milnor's Fibration Theorem for complex singularities*

Saturday August 15 — samedi 15 août

9:00 - 9:25	Jacques Hurtubise, *Moduli of instantons and calorons*
9:30 - 9:55	Ruxandra Moraru, *Compact moduli spaces of stable bundles on Kodaira surfaces*
13:30 - 13:55	Pedro Luis del Angel, *Variations of Mixed Hodge Structures associated to a singular family of Calabi–Yau 3-folds*
14:00 - 14:25	Marco Gualtieri, *Holomorphic Poisson structures*

Abstracts/Résumés

JANUSZ ADAMUS, The University of Western Ontario, London, Ontario, N6A 5B7, Canada
[Friday August 14 / vendredi le 14 août, 10:00 – FSC-1002]
Geometric Auslander criterion for flatness

Flatness is a subtle algebraic notion that expresses continuity of the fibres of a mapping, but it has remained geometrically elusive. The aim of this talk is to understand the notion of flatness in explicit geometric terms. We show that non-flatness of a morphism of schemes of finite type with a regular target of dimension n manifests in the existence of the so-called vertical components in the n-fold fibred power of the morphism (i.e., components with a nowhere dense image). This leads to an effective algorithm for flatness over regular affine algebras, by means of Grobner bases.

This work was done with E. Bierstone and P. D. Milman.

EDWARD BIERSTONE, Fields Institute, 222 College Street, Toronto, Ontario, Canada, M5T 3J1
[Thursday August 13 / jeudi le 13 août, 14:00 – FSC-1002]
Resolution except for minimal singularities

Can we find the smallest class of singularities $\mathcal{S}$ with the following properties:

(1) $\mathcal{S}$ includes all normal-crossings singularities;

(2) every reduced variety X admits a birational morphism $\sigma\colon X' \to X$ such that X' has only singularities in $\mathcal{S}$, and σ is an isomorphism over the locus of points of X having only singularities in $\mathcal{S}$?

I will address this question which has been raised by János Kollár.

LETICIA BRAMBILA, CIMAT A.C. Jalisco S/N Mineral de Valenciana 36240, Guanajuato, Guanajuato, Mexico
[Thursday August 13 / jeudi le 13 août, 11:00 – FSC-1002]
Moduli of coherent systems

Coherent systems are the analogous for higher classical linear systems. That is, a coherent system of type (n, d, k) is a pair (E, V) where E is a holomorphic bundle of rank n and degree d and V is a linear subspace of its space of holomorphic sections of dimension k. There is a stability notion for a pair (E, V), distinct from the stability of the bundle E. The natural definition of such stability depends on a real parameter α and leads to a finite family of moduli spaces of α-stable coherent systems. In this talk we will describe such moduli spaces for certain values of (n, d, k).

PATRICK BROSNAN, University of British Columbia
[Friday August 14 / vendredi le 14 août, 14:00 – FSC-1002]
Essential dimension for moduli stacks

I will present joint work with Angelo Vistoli and Zinovy Reichstein on essential dimension of the moduli stacks of curves and of abelian varieties. The main technical result used to compute this essential dimension is a "genericity theorem" which reduces the computation of the essential dimension of a smooth Deligne–Mumford stack to the essential dimension of its generic gerbe. I will sketch the proof of this result.

JIM BRYAN, Department of Math, UBC
[Thursday August 13 / jeudi le 13 août, 11:30 – FSC-1002]
The Donaldson–Thomas and Gromov–Witten theory of orbifolds and their resolutions

There are two primary theories of "curve counting" on a Calabi–Yau threefold, Donaldson–Thomas theory and Gromov–Witten theory. Both theories extend to Calabi–Yau orbifolds. A three dimensional Calabi–Yau orbifold X has a canonical Calabi–Yau resolution Y. The four curve counting theories $DT(X)$, $DT(Y)$, $GW(X)$, and $GW(Y)$ are expected to be equivalent. We give an overview of these theories and conjectural equivalences.

VICTOR CASTELLANOS, Universidad Juarez Autonoma de Tabasco, Av. Universidad s/n Zona de la Cultura, Col. Magisterial, 86040 Villahermosa Tabasco, México
[Friday August 14 / vendredi le 14 août, 9:30 – FSC-1002]
A Singular computation of the Poincaré–Hopf index of real-analytic vector fields

In this talk we present a generalized algebraic index formula for certain class of real-analytic vector fields with non-algebraically isolated singularities. In the algebraically isolated case, we compute the index with the library PHindex writing for the software Singular, using the Eisenbud–Levine–Khimshiashvili's algebraic index formula.

Algebraic Geometry and Singularity Theory
Géométrie algébrique et théorie des singularités

ABEL CASTORENA, IMUNAM–Morelia(Universidad Nacional Autonoma de Mexico), A.P. 61-3 (Xangari), CP 58089, Morelia, Mexico

[Thursday August 13 / jeudi le 13 août, 12:00 – FSC-1002]

A family of curves in the Severi variety with special moduli

Let C be an smooth complex algebraic curve of genus $g \geq 8$. Denote by K_C the canonical line bundle on C. Let $|L| = g^1_{g-2}$ a pencil on C free of base points such that the residual g^2_g of the g^1_{g-2} determines a birational map onto a plane curve of degree g and geometric genus g with $\delta = \frac{(g-1)(g-2)}{2}$ nodes as singularities. Consider the Petri map $\mu_L \colon H^0(C, L) \otimes H^0(C, K_C \otimes L^{-1}) \to H^0(C, K_C)$. We show that μ_L is not injective if and only there exists a curve F of degree $g-5$ containing $\delta - 1$ nodes of Γ.

Now consider the Severi Variety $\mathcal{V}^{g,g,\delta}$ of reduced and irreducible plane curves of degree g and genus g having δ nodes as singularities. Let $\mathcal{V}_g := \{\Gamma \in \mathcal{V}^{g,g,\delta} : \delta - 1 \text{ nodes lie on a curve of degree } g-5\}$. Let $\phi \colon \mathcal{V}^{\delta}_{g,g} \to \mathcal{M}_g$ the natural morphism to the moduli space of curves $\mathcal{M}_g$. We show that the image $\phi(\mathcal{V}_g)$ is a divisor in $\mathcal{M}_g$. We discuss the irreducibility of $\phi(\mathcal{V}_g)$ in some cases.

JOSE LUIS CISNEROS, Universidad Nacional Autónoma de México, Instituto de Matemáticas, Cuernavaca, México

[Friday August 14 / vendredi le 14 août, 14:30 – FSC-1002]

Refinements of Milnor's Fibration Theorem for complex singularities

Given a holomorphic map-germ $f \colon (\mathbb{C}^n, \underline{0}) \to (\mathbb{C}, 0)$ with a critical value at $0 \in \mathbb{C}$, there are two equivalent ways of defining its Milnor fibration. The first is:

$$\phi = \frac{f}{|f|} \colon \mathbb{S}_\epsilon \setminus K \longrightarrow \mathbb{S}^1, \tag{1}$$

where $K = f^{-1}(0) \cap \mathbb{S}_\epsilon$ is the link. The other, given essentially by Milnor himself by:

$$f \colon N(\epsilon, \eta) \longrightarrow \partial \mathbb{D}_\eta, \tag{2}$$

where $\epsilon \gg \eta > 0$ are sufficiently small, $\mathbb{D}_\eta \subset \mathbb{C}$ is the disc of radius η around $0 \in \mathbb{C}$, $\mathbb{B}_\epsilon$ is the ball of radius ϵ around $\underline{0} \in \mathbb{C}^n$ and $N(\epsilon, \eta)$ is the *Milnor tube* $\mathbb{B}_\epsilon \cap f^{-1}(\partial \mathbb{D}_\eta)$. (We remark that Milnor only proved that the fibres of (2) are equivalent to those of (1), and not that (2) is actually a fibre bundle; this was certainly known to Milnor when f has an isolated critical point, and later completed by Lê.)

We show that there is a canonical decomposition of the whole ball $\mathbb{B}_\epsilon$ into real analytic hypersurfaces X_θ that spin around their "axis" $V_\epsilon = f^{-1}(0) \cap \mathbb{B}_\epsilon$ forming a kind of "open-book" with singular binding. Using this decomposition we improve, or refine, Milnor's fibration theorem in several directions.

This is joint work with J. Seade and J. Snoussi.

PEDRO LUIS DEL ANGEL, Centro de Investigacion en Matematicas A.C.

[Saturday August 15 / samedi le 15 août, 13:30 – FSC-1002]

Variations of Mixed Hodge Structures associated to a singular family of Calabi–Yau 3-folds

We consider a particular family of singular Calabi–Yau 3-folds parametrized by $U = \mathbf{P}/1 - \{q_1, \ldots, q_6\}$. The singular locus of the fiber over u consists of exactly 100 nodes for every $u \in U$.

We study the monodromy action and in particular the variation of Hodge structure associated to the smooth family of the desingularizations.

MARCO GUALTIERI, University of Toronto, Toronto, ON

[Saturday August 15 / samedi le 15 août, 14:00 – FSC-1002]

Holomorphic Poisson structures

Algebraic Geometry and Singularity Theory
Géométrie algébrique et théorie des singularités

Holomorphic Poisson manifolds are highly constrained compared to their relatively flexible smooth counterparts. I shall describe some new results concerning the structure and classification of holomorphic Poisson manifolds.

JACQUES HURTUBISE, Dept. Mathematics, McGill University, 805 Sherbrooke St. W., Montreal H3A 2K6
[Saturday August 15 / samedi le 15 août, 9:00 – FSC-1002]
Moduli of instantons and calorons

The moduli spaces of instantons on the four-sphere and of calorons (instantons on the circle times R^3) turn out to be describable in terms of holomorphic maps from the Riemann sphere into a flag manifold of a loop group. These in turn, like for their finite dimensional cousins, admit a poles and principal parts description that allows one to describe the moduli and prove, for example, a topological stability theorem for the moduli.

Joint work with Michael Murray.

KIUMARS KAVEH, University of Toronto, 40 St. George St., Toronto, ON
[Thursday August 13 / jeudi le 13 août, 15:00 – FSC-1002]
Convex bodies for actions of reductive groups

Let X be a algebraic variety equipped with an action of a reductive algebraic group G. Also let L be a finite dimensional subspace of rational functions invariant under G. In this talk we discuss various convex bodies that one can associate to (X, L) which encode information about number of solutions of generic systems of equations from L plus information on multiplicities of irreducible representations appearing in powers L^k. Similarly one associates convex bodies to a projective G-variety X and a G-linearized line bundle L on X. These far generalize the notion of Newton convex polytope in toric geometry as well as Gelfand–Cetlin polytopes associated to irreducible representations of $\mathrm{GL}(n)$ (i.e., flag variety of $\mathrm{GL}(n)$).

This is a joint work with A. G. Khovanskii.

RUXANDRA MORARU, University of Waterloo
[Saturday August 15 / samedi le 15 août, 9:30 – FSC-1002]
Compact moduli spaces of stable bundles on Kodaira surfaces

In this talk, I will examine the geometry of moduli spaces of stable bundles on Kodaira surfaces, which are non-Kaehler compact surfaces that can be realised as torus fibrations over elliptic curves. These moduli spaces are interesting examples of holomorphic symplectic manifolds whose geometry is similar to the geometry of Mukai's moduli spaces on $K3$ and abelian surfaces.

ADRIANA ORTIZ, Universidad Nacional Autónoma de México
[Thursday August 13 / jeudi le 13 août, 14:30 – FSC-1002]
A formula for the Hessian curve and Cusps of Gauss of a real polynomial

Let $f \in \mathbb{R}[x, y]$ be a real polynomial such that its hessian curve in the xy-plane is compact. When the unbounded connected component C_u of the complement of the hessian curve is hyperbolic, the foliation of the asymptotic lines of C_u extends near of the point at infinity. Denote by $\tilde{C}_u$ the union of the component C_u with its boundary.

In this talk, the relation between the number of cusps of Gauss of $\tilde{C}_u$ and the number of connected components of the hessian curve in $\tilde{C}_u$ will be given, as well as its relation with the index of the field of asymptotic directions at infinity.

This result was obtained in collaboration with F. Sánchez-Bringas and L. I. Hernández-Martínez.

Algebraic Geometry and Singularity Theory
Géométrie algébrique et théorie des singularités

JOSE SEADE, Universidad Nacional Autónoma de México, Instituto de Matemáticas, Cuernavaca, México
[Friday August 14 / vendredi le 14 août, 9:00 – FSC-1002]
On the Chern classes of singular varities

The Chern classes of complex manifolds are important invariants that appear in many fields of geometry and topology. From the topological viewpoint, these are closely related to the local index of Poincaré–Hopf for vector fields, and generalizations of it to the case of sections of certain fibre bundles associated to the tangent bundle. It is natural to ask whether one has similar notions for complex analytic varieties. This is a question that goes back to the work of M. H. Schwartz in the 1960s, MacPherson in the 1970s, and many others after that. In this talk I will speak about work done mostly with Jean-Paul Brasselet and Tatsuo Suwa. We relate this problem with that of studying indices of vector fields on singular varieties, and the various generalizations one has for singular varieties of the concept of tangent bundle.

Analysis
Analyse

Org: Salvador Pérez-Esteva (UNAM) and/et **Malabika Pramanik** (UBC)

Schedule/Horaire **Room/Salle: FSC-1003**

Thursday August 13 — jeudi 13 août

11:00 - 11:50	Akos Magyar
12:00 - 12:25	Magali Folch, *An affine invariant inequality and applications in harmonic analysis*
14:00 - 14:25	Mahta Khosravi
14:30 - 14:55	Emilio Marmolejo, *Hardy Spaces, Singular Integrals and the Geometry of Euclidean Domains*
15:00 - 15:25	Galia Dafni, *An atomic decomposition of the Hajlasz Sobolev space M^1_1 on manifolds*

Friday August 14 — vendredi 14 août

9:00 - 9:25	Jorge Rivera-Noriega, *Some results on parabolic uniform rectifiability*
9:30 - 9:55	Ping Zhou, *On L^1-convergence of Fourier series under MVBV condition*
10:00 - 10:25	Lino Reséndiz, *$\mathcal{Q}_p$ n-dimensional classes*
13:30 - 13:55	Hong Yue, *A L^p-version of the John–Nirenberg Lemma in Metric Spaces*
14:00 - 14:25	Martha Guzmán-Partida, *Boundary values for conjugate Poisson transforms*
14:30 - 14:55	Brian Cook, *A Restricted Roth Theorem Over Finite Fields*

Saturday August 15 — samedi 15 août

9:00 - 9:50	Mónica Clapp, *Periodic and Bloch solutions to a magnetic nonlinear Schrödinger equation*
10:00 - 10:25	Kathryn Hare, *Sets of zero discrete harmonic density*
13:30 - 13:55	Marcos López, *Functional equations related to indeterminate moment problems*
14:00 - 14:25	Leandro Zuberman, *A Fractal Plancherel Theorem*

Abstracts/Résumés

MÓNICA CLAPP, Universidad Nacional Autónoma de México, Instituto de Matemáticas, Circuito Exterior C.U., 04510 México D.F., Mexico

[Saturday August 15 / samedi le 15 août, 9:00 – FSC-1003]

Periodic and Bloch solutions to a magnetic nonlinear Schrödinger equation

We consider the equation

$$(\wp_A) \quad (-i\nabla + A)^2 u + Vu = |u|^{p-2}u,$$

where $A \in C^{1,\alpha}(\mathbb{R}^N, \mathbb{R}^N)$ is the magnetic potential associated to a magnetic field $B = \operatorname{curl}(A)$ and $V \in C^{0,\alpha}(\mathbb{R}^N)$ is an electric potential. We assume that A and V are 2π-periodic in each variable, $V > 0$, and $p \in (2, 2^*)$ with $2^* := \infty$ if $N = 2$, $2^* := \frac{2N}{N-2}$ if $N \geq 3$. We shall address two questions: the gauge-dependence problem for 2π-periodic solutions $u\colon \mathbb{R}^N \to \mathbb{C}$, and the multiplicity of Bloch solutions. Unlike the nonperiodic case where problem $(\wp_A)$ is basically independent of A (it is gauge invariant), in the periodic case this is far from being true. Under some assumptions on A we show that, if there exists a one-to-one correspondence between the 2π-periodic solutions of $(\wp_A)$ and those of $(\wp_{A+z})$ preserving their absolute value, then z lies in a subset of measure zero of $\mathbb{R}^N$. We use this fact to show the existence of an uncountable set of Bloch solutions with real quasimomentum having small energy.

This is joint work with Renato Iturriaga and Andrzej Szulkin.

Analysis
Analyse

BRIAN COOK, University of British Columbia
[Friday August 14 / vendredi le 14 août, 14:30 – FSC-1003]
A Restricted Roth Theorem Over Finite Fields

Given a set $A \subset \mathbb{F}_p^n$ with at least δp^n elements, $\delta > 0$, we will discuss finding triples $\{(x, x+d, x+2d) \in A \times A \times A : d \in V\}$, where $V = \{x \in \mathbb{F}_p^n : f_1(x) = \cdots = f_R(x) = 0\}$ is the zero set of homogeneous polynomials $f_1, \ldots, f_R$ all of fixed degree d.

This is joint work with Akos Magyar.

GALIA DAFNI, Concordia University, 1455 de Maisonneuve Blvd. West, Montreal, Quebec H3G 1M8
[Thursday August 13 / jeudi le 13 août, 15:00 – FSC-1003]
An atomic decomposition of the Hajlasz Sobolev space M_1^1 on manifolds

We compare several possible notions of Hardy–Sobolev spaces on a manifold with a doubling measure. In particular, we consider several characterizations of these spaces, in terms of maximal functions, atomic decompositions, and gradients, and apply them to the L^1 Sobolev space M_1^1, defined by Hajlasz.

Joint work with N. Badr.

MAGALI FOLCH, Instituto de Matemáticas, UNAM
[Thursday August 13 / jeudi le 13 août, 12:00 – FSC-1003]
An affine invariant inequality and applications in harmonic analysis

We extend an affine invariant inequality previously established for vector polynomials to general rational functions. We then prove several estimates for problems in harmonic analysis defined with respect to the affine arc-length measure.

This is joint work with Spyridon Dendrinos (University of Bristol) and James Wright (University of Edinburgh).

MARTHA GUZMÁN-PARTIDA, Universidad de Sonora, Rosales y Luis Encinas, Hermosillo, Mexico
[Friday August 14 / vendredi le 14 août, 14:00 – FSC-1003]
Boundary values for conjugate Poisson transforms

We define a family of conjugate Poisson transforms for distributions T in the weighted space $w_1 \cdots w_n D'_{L^1}$, by means of the S'-convolution. We prove that their boundary values in the topology of this space of distributions are of the form $H(T)$ where H is the n-dimensional Hilbert transform of T.

KATHRYN HARE, University of Waterloo
[Saturday August 15 / samedi le 15 août, 10:00 – FSC-1003]
Sets of zero discrete harmonic density

The set $E \subseteq \mathbb{Z}$ is said to have zero discrete harmonic density (zdhd) if for every open $U \subseteq \mathbb{T}$ and discrete measure μ, there is a discrete measure, ν, supported on U with $\widehat{\mu} = \widehat{\nu}$ on E. I_0 sets are examples of sets which have zdhd. We study properties of these sets. Our motivation is to provide a new approach to two long-standing problems involving Sidon sets.

This is joint work with Colin Graham.

MAHTA KHOSRAVI, UBC
[Thursday August 13 / jeudi le 13 août, 14:00 – FSC-1003]

Analysis
Analyse

MARCOS LÓPEZ, UNAM, Área de la investigación Científica, Cd. Universitaria Coyoacán 04510, México D.F.
[Saturday August 15 / samedi le 15 août, 13:30 – FSC-1003]
Functional equations related to indeterminate moment problems

For $\beta \in \mathbb{R}$, $p > 0$, and $0 < q < 1$ fixed, we characterize the integrable functions on $(0, \infty)$ satisfying the functional equation $f(qx) = q^{\beta-1/2}(x + pq^{-1/2})f(x)$, and show that they are solutions to the generalized Stieltjes–Wigert moment problem.

AKOS MAGYAR, UBC
[Thursday August 13 / jeudi le 13 août, 11:00 – FSC-1003]

EMILIO MARMOLEJO, Instituto de Matematicas, Unidad Cuernavaca, UNAM, Mexico
[Thursday August 13 / jeudi le 13 août, 14:30 – FSC-1003]
Hardy Spaces, Singular Integrals and the Geometry of Euclidean Domains

We study the interplay between the geometry of Hardy spaces and functional analytic properties of singular integral operators (SIO's), such as the Riesz transforms as well as Cauchy-Clifford and harmonic double layer operator, on the one hand and, on the other hand, the regularity and geometric properties of domains of locally finite perimeter. Among other things, we give several characterizations of Euclidean balls, their complements, and half-spaces, in terms of the aforementioned SIO's.

Joint work with Steve Hofmann, Salvador Perez-Esteva, Marius Mitrea and Michael Taylor.

LINO RESÉNDIZ, Universidad Autonoma Metropolitana–Azcapotzalco, Av. San Pablo 180, Mexico D.F.
[Friday August 14 / vendredi le 14 août, 10:00 – FSC-1003]
$\mathcal{Q}_p$ n-dimensional classes

Let $n \geq 3$ and B be the unit ball in $\mathbb{R}^n$. Denote by $\mathrm{GM}(B) = \{\phi_{a^*}\}$ the group of all Möbius transformations of the unit ball onto itself and $\mathcal{SH}$ the class of subharmonic functions $u\colon B \to \mathbb{R}$. Consider

$$g(x, a^*) = |\phi_{a^*}(x)|^{2-n} - 1 = \frac{1}{|\phi_{a^*}(x)|^{n-2}} - 1,$$

the modified solution of the Laplacian in $\mathbb{R}^n$ compose with a Möbius transformation ϕ_{a^*} of the unit ball onto itself. Let $0 \leq p < \infty$. We say that the function u belongs to the subharmonic class $\mathcal{Q}^{sh}_{p,g}$ if $u \in \mathcal{SH}$ and

$$\sup_{|a^*|<1} \int_B u^2(x) \Big(\frac{1}{|\phi_{a^*}(x)|^{n-2}} - 1 \Big)^p \, dB_x < \infty.$$

In this talk we present several properties of this class and associated subclasses, like Dirichlet and Bloch classes. Classical $\mathcal{Q}_p$-analytic spaces in $\mathbb{C}$ were introduced by Aulaskari and Lappan. In higher dimensions, $\mathcal{Q}_p$-monogenic spaces were studied using Quaternionic and Clifford analysis. Since the subharmonic class is a very wide class, the results presented here are quite more general.

JORGE RIVERA-NORIEGA, Universidad Autonoma del Estado de Morelos
[Friday August 14 / vendredi le 14 août, 9:00 – FSC-1003]
Some results on parabolic uniform rectifiability

In a couple of relatively recent works S. Hofmann, J. L. Lewis and K. Nyström have introduced the notion of *uniformly rectifiable sets in the parabolic sense*. In their works they also establish analogous versions of results of results of C. Kenig and

T. Toro (on harmonic measure on locally flat domains), including the notion of *parabolic chord arc domains*. Our aim is to present some further developments related with the notion of big pieces of graphs.

HONG YUE, Trine University, 1 University Ave., Angola, IN, 46703, USA
[Friday August 14 / vendredi le 14 août, 13:30 – FSC-1003]
A L^p-version of the John–Nirenberg Lemma in Metric Spaces

John and Nirenberg (1961) introduced the space $BMO(Q)$ and a larger space which we call the John–Nirenberg space with exponent p and denote by $JN_p(Q)$, where Q is a finite cube in $\mathbb{R}^n$. They proved two lemmas for functions in $BMO(Q)$ and $JN_p(Q)$ respectively. The first one characterizes functions in $BMO(Q)$ in terms of the exponential decay of the distribution function of their oscillations. The second shows that any function in $JN_p(Q)$ is in weak $L^p(Q)$.

We first give a new proof for John–Nirenberg lemma II on $\mathbb{R}^n$ by using a dyadic maximal operator and a good lambda inequality. Then, we discuss the space JN_p and the corresponding lemma in the context of a doubling metric measure space.

Joint work with D. Aalto, L. Berkovits, O. E. Maasalo.

PING ZHOU, St. Francis Xavier University
[Friday August 14 / vendredi le 14 août, 9:30 – FSC-1003]
On L^1-convergence of Fourier series under MVBV condition

Let $f \in L_{2\pi}$ be a real-valued even function with its Fourier series

$$\frac{1}{2}a_0 + \sum_{n=1}^{\infty} a_n \cos nx,$$

and let $S_n(f,x)$, $n \geq 1$, be the n-th partial sum of the Fourier series. It is well known that if the nonnegative sequence $\{a_n\}$ is decreasing and $\lim_{n\to\infty} a_n = 0$, then

$$\lim_{n\to\infty} \|f - S_n(f)\|_L = 0$$

if and only if

$$\lim_{n\to\infty} a_n \log n = 0.$$

We weaken the monotone condition in this classical result to the so-called mean value bounded variation (MVBV) condition. Our main result gives the L^1-convergence of a function $f \in L_{2\pi}$ in complex space, and the generalization of the above classical result is a special case in the real-valued function space.

This is joint work with D. S. Yu and S. P. Zhou.

LEANDRO ZUBERMAN, University of Waterloo, Pure Math Department, Waterloo, Ontario, Canada, N2L 3G1
[Saturday August 15 / samedi le 15 août, 14:00 – FSC-1003]
A Fractal Plancherel Theorem

A measure μ on $\mathbb{R}^n$ is called locally and uniformly h-dimensional if $\mu\big(B_r(x)\big) \leq h(r)$ for all $x \in \mathbb{R}^n$ and for all $0 < r < 1$, where h is a real valued function. If $f \in L^2(\mu)$ and $\mathcal{F}_\mu f$ denotes its Fourier transform with respect to μ, it is not true that $\mathcal{F}_\mu f \in L^2$.

We prove that, under certain hypothesis on h, for any $f \in L^2(\mu)$ the L^2-norm of its Fourier transform restricted to a ball of radius r has the same order of growth as $r^n h(r^{-1})$, when $r \to \infty$. Moreover, we prove that the ratio between these quantities is bounded by the $L^2(\mu)$-norm of f:

$$\sup_{x\in\mathbb{R}^n} \sup_{r\geq 1} \frac{1}{r^n h(r^{-1})} \int_{B_r(x)} |\mathcal{F}_\mu f(\xi)|^2 \, d\xi \leq C\|f\|_2^2.$$

By imposing certain restrictions on the measure μ, we can also obtain a lower bound for this ratio:

$$\liminf_{r\to\infty} \frac{1}{r^n h(r^{-1})} \int_{B_r(y)} |\mathcal{F}_\mu f(\xi)|^2 \, d\xi \geq c \int_E |f|^2 \, d\,\mathrm{hau}^h \,.$$

These results generalize the ones obtained by Strichartz in [1] where he considered the particular case in which $h(x) = x^\alpha$.

References

[1] R. Strichartz, *Fourier asymptotics of fractal measures*. J. Funct. Anal. **89**(1990), 154–187.

Combinatorics and Graph Theory
Combinatoire et théorie des graphes

Org: Hortensia Galeana (IMATE-UNAM), **Luis Goddyn** (SFU) and/et **Miguel Pizaña** (UAM-I)

Schedule/Horaire **Room/Salle: FSC-1220**

Thursday August 13 — jeudi 13 août

11:00 - 11:25	Petr Lisonek, *Latin bitrades and Eulerian triangulations*
11:30 - 11:55	Miguel Pizaña, *On the clique behavior of locally small graphs*
12:00 - 12:25	Paco Larrión, *The fundamental group of the clique graph*
14:00 - 14:25	Chris Godsil, *Graph spectra and quantum computing*
14:30 - 14:55	Gabriela Araujo, *Geometric constructions of small regular bipartite graphs of girth 6*
15:00 - 15:25	Joy Morris, *Structure of strongly regular vertex- and edge-transitive graphs*

Friday August 14 — vendredi 14 août

9:00 - 9:25	Mike Newman, *Matroid Asymptotics*
9:30 - 9:55	Ricardo Strausz, *On the pseudoachromatic index of the complete graph*
10:00 - 10:25	Sean McGuinness, *A Base Exchange Property for Regular Matroids*
13:30 - 13:55	Bertrand Guenin, *Flows in binary matroids*
14:00 - 14:25	Eduardo Rivera, *Variations on the heterochromatic number*
14:30 - 14:55	Martín Manrique, *Level Hypergraphs*

Saturday August 15 — samedi 15 août

9:00 - 9:25	Pavol Hell, *Variants of interval digraphs*
9:30 - 9:55	Hortensia Galeana, *Cycle pancyclism in digraphs*
10:00 - 10:25	Isidoro Gitler, *Toric Ideals Complete Intersection of Oriented Graphs and Generalized-Theta Graphs*
13:30 - 13:55	Bojan Mohar, *Chromatic number and complete graph substructures for degree sequences*
14:00 - 14:25	Andrew King, *Fractional and integer colourings in claw-free graphs*
14:30 - 14:55	Juan José Montellano, *Some Turan and anti-Ramsey numbers*

Abstracts/Résumés

GABRIELA ARAUJO, Universidad Nacional Autónoma de México

[Thursday August 13 / jeudi le 13 août, 14:30 – FSC-1220]

Geometric constructions of small regular bipartite graphs of girth 6

In this talk we exhibit some structures in the projective plane of order q which allow us to find q-regular balanced bipartite graphs of girth 6 and $2(q^2-1)$ vertices and k-regular balanced bipartite digraph with $2(qk-2)$ vertices for all $k \leq q-1$, where k is an integer and q is a prime power with $3 \leq k \leq q-1$. These graphs have the smallest number of vertices known so far among the regular graphs with girth 6 and improve the recent results on this topic.

Joint work with Camino Balbuena, Universidad Politécnica de Cataluña, España.

HORTENSIA GALEANA, Universidad Nacional Autónoma de México, Instituto de Matemáticas, Area de la Investigación Científica 04510, México, D.F.

[Saturday August 15 / samedi le 15 août, 9:30 – FSC-1220]

Cycle pancyclism in digraphs

The subject of pancyclism in digraphs has been studied by several authors meanly in tournaments and nearly tournaments. A digraph is vertex-pancyclism if given a vertex v there are cycles of every length containing v. Similarly, a digraph is arc-pancyclic if given any arc e there are cycles of every length containing e.

In this talk we deal with the concept of cycle-pancyclism to study questions as the following. Given a cycle C, what is the maximum number of arcs which a cycle of length k contained in D has in common with C?

Assuming that γ is a hamiltonian cycle of the digraph D; and C_k a directed cycle of length k, we denote $\mathcal{I}_\gamma(C_k) = |A(\gamma) \cap A(C_k)|$. We determine $f(n,k,D) = \max\{\mathcal{I}_\gamma(C_k) \mid C_k \subseteq D\}$, in case that D is a tournament a bipartite tournament or a multipartite tournament.

This is joint work with S. Rajsbaum.

ISIDORO GITLER, Cinvestav
[Saturday August 15 / samedi le 15 août, 10:00 – FSC-1220]
Toric Ideals Complete Intersection of Oriented Graphs and Generalized-Theta Graphs

Let G be a connected graph with n vertices and q edges and let $\mathcal{O}$ be an orientation of the edges of G, i.e., an assignment of a direction to each edge of G. Thus $\mathcal{D} = (G, \mathcal{O})$ is an *oriented graph*. To each oriented edge $e = (x_i, x_j)$ of $\mathcal{D}$, we associate the vector v_e defined as follows: the i-th entry is -1, the j-th entry is 1, and the remaining entries are zero. The *incidence matrix* $A_\mathcal{D}$ of $\mathcal{D}$ is the $n \times q$ matrix with entries in $\{0, \pm 1\}$ whose columns are the vectors of the form v_e, with e an edge of $\mathcal{D}$. For simplicity of notation we set $A = A_\mathcal{D}$. The set of column vectors of A will be denoted by $\mathcal{A} = \{v_1, \ldots, v_q\}$.

Consider the *edge subring* $k[\mathcal{D}] := k[x^{v_1}, \ldots, x^{v_q}] \subset k[x_1^{\pm 1}, \ldots, x_n^{\pm 1}]$ of the oriented graph $\mathcal{D}$. There is an epimorphism of k-algebras

$$\varphi\colon B = k[t_1, \ldots, t_q] \longrightarrow k[\mathcal{D}], \quad t_i \longmapsto x^{v_i},$$

where B is a polynomial ring. The kernel of φ, denoted by $P_\mathcal{D}$, is called the *toric ideal* of $\mathcal{D}$. This ideal was studied in [2], [3]. Notice that $P_\mathcal{D}$ is no longer a graded ideal, see Proposition **??**. The toric ideal $P_\mathcal{D}$ is a prime ideal of height $q-n+1$ generated by binomials and $k[\mathcal{D}]$ is a normal domain. Thus any minimal generating set of $P_\mathcal{D}$ must have at least $q - n + 1$ elements, by the principal ideal theorem. If $P_\mathcal{D}$ can be generated by $q - n + 1$ polynomials it is called a complete intersection. In [3] is shown that any graph has an acyclic orientation such that the corresponding toric ideal is a complete intersection. And a graph G is called complete intersection for all orientation (C.I.O.) if P_D is a complete intersection, for all D orientation of G.

We introduce the generalized-theta graph. The theta graphs studied in [1] are generalized-theta graphs. Our main result is: G is C.I.O. if and only if all generalized thetas of G have a special triangle. We obtain a characterization of the ring graphs in term of the generalized theta graph. With this result we recover the characterization of the C.I.O. bipartite graphs given in [3].

References

[1] M. Chudnovsy and S. Safra, *Detecting a theta or a prism.* SIAM J. Discrete Math. **22**(2008), 1164–1186.

[2] I. Gitler, E. Reyes and R. H. Villarreal, *Ring graphs and toric ideals.* Electron. Notes Discrete Math. **28C**(2007), 393–400.

[3] ———, *Ring graphs and complete intersection toric ideals.* Discrete Math., to appear.

CHRIS GODSIL, University of Waterloo, Waterloo, ON, N2L 3G1
[Thursday August 13 / jeudi le 13 août, 14:00 – FSC-1220]
Graph spectra and quantum computing

As a graduate student, I was fascinated to learn that the eigenvalues of a graph could actually provide useful information about its structure. I started work on this topic, and never outgrew my interest in it—it seemed a harmless enough amusement. But

recently I have been surprised to find that a number of questions arising in quantum computing could be profitably attacked using results and techniques from the theory of graph spectra. In my talk I will present some of these problems (in graph theoretic terms), and discuss what progress has been made.

BERTRAND GUENIN, University of Waterloo, 200 University Avenue West, Ontario, Canada N2L 3G1
[Friday August 14 / vendredi le 14 août, 13:30 – FSC-1220]
Flows in binary matroids

The max-flow min-cut theorem in graphs does not extend to binary matroids in general. However, Seymour conjectured that this minimax relation holds as long as the binary matroids do not contain any one of three special obstructions. We discuss progress on this conjecture.

PAVOL HELL, Simon Fraser University, Burnaby, BC, V5A 1S6
[Saturday August 15 / samedi le 15 août, 9:00 – FSC-1220]
Variants of interval digraphs

I will discuss various directed analogues of interval graphs and proper interval graphs, their forbidden structure characterizations, and polynomial recogniziton algorithms. These concepts are motivated by the relation with graph polymorphisms, which play a role in solving constraint satisfaction problems.

This is joint work with Arash Rafiey, Jing Huang, and Tomas Feder.

ANDREW KING, McGill University, Montreal; Institute for Theoretical Computer Science, Prague
[Saturday August 15 / samedi le 15 août, 14:00 – FSC-1220]
Fractional and integer colourings in claw-free graphs

Chudnovsky and Seymour recently characterized the structure of claw-free graphs, generalizing previous work by Maffray and Reed on Berge claw-free graphs. When the stability number is at least four, a claw-free graph is a particular generalization of a line graph.

In this work, we combine this structure with known results on fractional and integer colourings of line graphs. We previously used this approach to extend a conjecture of Reed ($\chi \leq \lceil \frac{1}{2}(\Delta + 1 + \omega) \rceil$ for all graphs) from line graphs to claw-free graphs. More recently, we have proved that the fractional and integer chromatic numbers agree asymptotically for claw-free graphs with stability number at least four. This extends a probabilistic result of Kahn on line graphs, using the structural decomposition provided by Chudnovsky and Seymour.

Our proofs lead to polynomial-time algorithms for finding near-optimal colourings of claw-free graphs.

This is joint work with Bruce Reed.

PACO LARRIÓN, UNAM, Ciudad Universitaria, México, D.F. Mexico
[Thursday August 13 / jeudi le 13 août, 12:00 – FSC-1220]
The fundamental group of the clique graph

The *cliques* of a graph G are its maximal complete subraphs or, rather, their vertex sets. The *clique graph* of G is the intersection graph $K(G)$ of its cliques, so the vertices of $K(G)$ are the cliques of G, and two of them are neighbours in $K(G)$ if they are distinct and share at least one vertex. The *iterated clique graphs* of G are recursively defined by $K^0(G) = G$ and $K^{n+1}(G) = K\big(K^n(G)\big)$.

We are interested in the dynamical behaviour of a graph G under the clique graph operator K. For instance, G is K-*null* if some iterated clique graph $K^n(G)$ is the trivial graph K_1. More generally, G is K-*convergent* if $K^m(G) \cong K^n(G)$ for some

pair $m < n$. It is easy to see that G is not K-convergent precisely when it is K-*divergent*, in the sense that the order of $K^n(G)$ tends to infinity with n.

The complete subgraphs of G, viewed as vertex sets, form a simplicial complex. Via the geometric realization of this complex, we can consider the graph G as a topological space. Erich Prisner proved in 1992 that the first modulo two homology group of $K(G)$ is the same as that of G, and we proved recently the stronger statement that the fundamental group of $K(G)$ coincides with that of G. This gives a necessary condition for a graph to be K-null.

The talk is about joint work with M. A. Pizaña and R. Villarroel-Flores.

PETR LISONEK, Simon Fraser University, Burnaby, BC, Canada
[Thursday August 13 / jeudi le 13 août, 11:00 – FSC-1220]
Latin bitrades and Eulerian triangulations

Informally, a Latin bitrade is a pair of partial Latin squares obtained by superimposing two Latin squares (of the same order and with the same symbol set) and removing from both squares those cells that contain the same symbol in corresponding positions.

Latin bitrades which satisfy some natural conditions (that can be easily achieved) correspond to vertex 3-colourable Eulerian triangulations of orientable surfaces. This leads to a natural definition of the genus of a Latin bitrade. It was recently shown that all spherical Latin bitrades can be embedded in a finite Abelian group while there exist toroidal Latin bitrades that can be embedded in no group.

We show that spherical Latin bitrades correspond to spherical Eulerian triangulations (that is, the vertex 3-colourability is implied in this case). We prove that the algorithm for inductive generation of spherical Eulerian triangulations (due to Batagelj, Brinkmann and McKay) can be simplified by removing one of the two local transformations that it uses. We discuss an analogous algorithm for generation of toroidal Latin bitrades.

This is joint work with N. Cavenagh and A. Drapal.

MARTÍN MANRIQUE, Universidad Nacional Autónoma de México, Ciudad Universitaria, D.F., México
[Friday August 14 / vendredi le 14 août, 14:30 – FSC-1220]
Level Hypergraphs

Given a hypergraph $H = (E_x, \ldots, E_m)$, its level-hypergraph L_H is the result of identifying all vertices which belong to exactly the same edges. This new hypergraph has the same edge-structure as the original one, but may have less vertices. The tool makes it possible to emulate known theorems given in terms of order or rank; the new results are stated in terms of edge-structure, and usually apply to different classes of hypergraphs than the original statements, though there are some improvements on known results.

On the other hand, the study of several characteristics of a given hypergraph H is simplified, since many hypergraph invariants are preserved. For example: H is simple if, and only if, L_H is simple; H has repeated edges if, and only if, L_H does too; $\nu(H) = \nu(L_H)$, where $\nu(H)$ is the maximum cardinality of a matching in H; the minimum cardinality of a transversal set, the maximum cardinality of a transversal set not contained properly in other transversal, and the minimum cardinality of a strongly stable set are also equal in both H and L_H. Moreover, H is balanced (respectively totally balanced) if, and only if, L_H is balanced (respectively totally balanced); H is unimodular (respectively strongly unimodular) if, and only if, L_H is unimodular (respectively strongly unimodular), and $\Lambda(H) = \Lambda(L_H)$, $\lambda(H) = \lambda(L_H)$.

References

[1] B. D. Acharya, unpublished Manuscript, MRI, 1979.

[2] C. Berge, *The Theory of Graphs*. Dover Publications, New York, 2001.

[3] ———, *Hypergraphs. Combinatorics of Finite Sets.* Elsevier Science Publishers, Amsterdam, 1989.

SEAN McGUINNESS, Thompson Rivers University, Kamloops, BC
[Friday August 14 / vendredi le 14 août, 10:00 – FSC-1220]
A Base Exchange Property for Regular Matroids

In 1980, White conjectured that for any two bases B and B' of a regular matroid, there is an element $e \in B$ such that there is a unique element $f \in B'$ for which both $(B\backslash\{e\}) \cup \{f\}$ and $(B'\backslash\{f\}) \cup \{e\}$ are bases of M. In this talk, we outline a proof of this conjecture.

BOJAN MOHAR, Simon Fraser University
[Saturday August 15 / samedi le 15 août, 13:30 – FSC-1220]
Chromatic number and complete graph substructures for degree sequences

Given a graphic degree sequence D, let $\chi(D)$ (respectively $\omega(D)$, $h(D)$, and $H(D)$) denote the maximum value of the chromatic number (respectively, the size of the largest clique, largest clique subdivision, and largest clique minor) taken over all graphs whose degree sequence is D. It is proved that $\chi(D) \leq h(D)$. Moreover, it is shown that a subdivision of a clique of order $\chi(D)$ exists where each edge is subdivided at most once and the set of all subdivided edges forms a collection of disjoint stars. This bound is an analogue of the Hajós Conjecture for degree sequences and, in particular, settles a conjecture of Neil Robertson that degree sequences satisfy the bound $\chi(D) \leq H(D)$ (which is related to the Hadwiger Conjecture). It is also proved that $\chi(D) \leq \frac{6}{5}\omega(D) + \frac{3}{5}$ and that $\chi(D) \leq \frac{4}{5}\omega(D) + \frac{1}{5}\Delta(D) + 1$, where $\Delta(D)$ denotes the maximum degree in D. The latter inequality is a strengthened version of a conjecture of Bruce Reed. All derived inequalities are best possible.

This is a joint work with Zdenek Dvorak.

JUAN JOSÉ MONTELLANO, Universidad Nacional Autonoma de Mexico, Instituto de Matematicas, U.N.A.M., Area de la investigacion cientifica, Circuito Exterior, Ciudad Universitaria Coyoacan, 04510 Mexico D.F., Mexico
[Saturday August 15 / samedi le 15 août, 14:30 – FSC-1220]
Some Turan and anti-Ramsey numbers

Let G be a graph obtained by adding a chord to a cycle, and let $C(G)$ be the set of cycles which are subgraphs of G. Here we study the relation between $\mathrm{ex}\big(n, C(G)\big)$ and $f(n, G)$, where $\mathrm{ex}\big(n, C(G)\big)$ is the maximum number of edges of a graph on n vertices with no subgraph isomorphic to an element of $C(G)$; and $f(n, G)$ is the minimum integer k such that for every edge-coloring of the complete graph of order n which uses exactly k colors, there is at least one copy of G all whose edges have different colors.

In particular we show that if G is the diamond (C_4 with a chord), then

$$\mathrm{ex}(n, \{C_3, C_4\}) + 2 \leq f(n, G) \leq \mathrm{ex}(n, \{C_3, C_4\}) + (n + 1).$$

JOY MORRIS, University of Lethbridge, Lethbridge, AB, T1K 3M4
[Thursday August 13 / jeudi le 13 août, 15:00 – FSC-1220]
Structure of strongly regular vertex- and edge-transitive graphs

I will discuss the use of normal quotient reduction to analyse families of vertex-transitive, edge-transitive graphs. This method has been used extensively by Cheryl Praeger and others. In this talk, we apply the method to strongly regular graphs that are vertex- and edge-transitive.

In this talk, I will present some analysis of graphs in this family whose normal quotient is a complete graph, and the result that irreducible graphs in this family have quasiprimitive groups of automorphisms. Our main result is that no graph in this family can have a holomorphic simple group of automorphisms.

This is joint work with Cheryl Praeger and Pablo Spiga.

MIKE NEWMAN, University of Ottawa
[Friday August 14 / vendredi le 14 août, 9:00 – FSC-1220]
Matroid Asymptotics

We consider the properties of a random matroid: what does it look like? It turns out that very little is known, in stark contrast to random graphs, or even random matroids over a fixed finite field.

We show that asymptotically at least half of all matroids are connected, and outline some ideas that might be able to prove the "truth", that is that a.a.s. all matroids are connected, or even highly connected. We make several conjectures on properties that should hold a.a.s. for all matroids. We also describe a possible approach to generating a random matroid that is work in progress.

This is joint work with Dillon Mayhew, Dominic Welsh and Geoff Whittle.

MIGUEL PIZAÑA, Universidad Autonoma Metropolitana–Iztapalapa, Av. San Rafael Atlixco 186, Mexico City, 09340, Mexico
[Thursday August 13 / jeudi le 13 août, 11:30 – FSC-1220]
On the clique behavior of locally small graphs

We shall sketch the proof of the following theorem:

Theorem 1 *If G_1 and G_2 are both locally H and $|H| \leq 6$, then G_1 and G_2 have the same clique behavior.*

We say that a graph G is locally H if the neighbors of every vertex induce a subgraph isomorphic to H. Hall classified in 1985 the graphs H with at most 6 vertices, such that there exist at least one finite graph G which is locally H. The clique graph $K(G)$ of G is the intersection graph of all the (maximal) cliques of G. Iterated clique graphs are then defined recursively by $K^0(G) = G$ and $K^n(G) = K\big(K^{n-1}(G)\big)$. When the sequence of orders of the iterated clique graphs of G is unbounded, we say that G is clique divergent, otherwise it is clique convergent. We say that two graphs have the same clique behavior when both graphs are clique divergent or both graphs are clique convergent.

Joint work with Paco Larrión and Rafael Villarroel-Flores.

EDUARDO RIVERA, Universidad Autónoma Metropolitana, Iztapalapa, Av. San Rafael Atlixco 186, México D.F. 09340, México
[Friday August 14 / vendredi le 14 août, 14:00 – FSC-1220]
Variations on the heterochromatic number

Let H be a hypergraph and c be a colouring of the vertex set $V(H)$ of H. An edge e of H is a *heterochromatic edge* if c assigns different colours to different vertices of e. The *heterochromatic number* of H is the smallest integer k such that every colouring of $V(H)$ with k or more colours produces at least one heterochromatic edge. In this talk we give bounds for the heterochromatic number of certain hypergraphs associated to abstract graphs and to geometric graphs.

This is joint work with Juan José Montellano-Ballesteros.

Combinatorics and Graph Theory
Combinatoire et théorie des graphes

RICARDO STRAUSZ, Instituto de Matematicas, Universidad Nacional Autonoma de Mexico
[Friday August 14 / vendredi le 14 août, 9:30 – FSC-1220]
On the pseudoachromatic index of the complete graph

Let $n = q^2 + q + 1$, where $q = 2^p$. It will be shown that the pseudoachromatic index of the complete graph of order $n + q + 1$ equals $q^3 + 2q^2 + 3q$. Besides this result, it will be discussed the state-of-the-art on the problem of calculating such a parameter for all complete graphs.

Differential Geometry
Géométie differentielle

Org: Niky Kamran (McGill), **Oscar Palmas** (UNAM) and/et **Adolfo Sanchez Valenzuela** (CIMAT)

Schedule/Horaire **Room/Salle: FSC-1615**

Thursday August 13 — jeudi 13 août

11:00 - 11:25	Catherine Searle, *Non-negatively curved manifolds with maximal symmetry rank*
11:30 - 11:55	McKenzie Wang, *Examples of Ricci Solitons*
12:00 - 12:25	Olaf Muller, *Foliations of globally hyperbolic manifolds*
14:00 - 14:25	Ailana Fraser, *Minimal surfaces, conformal geometry, and the Dirichlet-to-Neumann map*
14:30 - 14:55	Gabriel Ruiz Hernandez, *Higher codimensional Euclidean helix submanifolds*
15:00 - 15:25	Benoit Charbonneau, *Singular monopoles on the product of a circle and a surface*

Friday August 14 — vendredi 14 août

9:00 - 9:25	Federico Sánchez Bringas
9:30 - 9:55	Haydeé Herrera-Guzmán, *Complex contact manifolds and S^1 actions*
10:00 - 10:25	Spiro Karigiannis, *Curvature of the moduli space of G_2 metrics*
13:30 - 13:55	Albert Chau, *Lagrangian mean curvature flow for entire Lipschitz graphs*
14:00 - 14:25	Andrés Pedroza, *Seidel's Morphism on the Hamiltonian Group of a Cartesian Product*
14:30 - 14:55	Tom Ivey, *Cable knot solutions of the vortex filament flow*

Saturday August 15 — samedi 15 août

9:00 - 9:25	Hugues Lapointe, *Spectral function of the Laplacian on a Riemannian manifold: dynamical features and average growth*
9:30 - 9:55	Gregor Weingart, *Sectional Curvature Integrals*

Abstracts/Résumés

FEDERICO SÁNCHEZ BRINGAS, Ciencias, UNAM
[Friday August 14 / vendredi le 14 août, 9:00 – FSC-1615]

BENOIT CHARBONNEAU, Duke University, Durham, NC, USA
[Thursday August 13 / jeudi le 13 août, 15:00 – FSC-1615]
Singular monopoles on the product of a circle and a surface

In this talk, I will discuss work done with Jacques Hurtubise (McGill) to relate singular solutions to the Bogomolny equation on a circle times a surface to pairs [holomorphic bundle, meromorphic endomorphism] on the surface. The endomorphism is meromorphic, generically bijective, and corresponds to a return map. Its poles and zeros are related to the singularities of the corresponding solution to the Bogomolny equation.

This talk is based on arXiv:0812.0221.

ALBERT CHAU, University of British Columbia
[Friday August 14 / vendredi le 14 août, 13:30 – FSC-1615]
Lagrangian mean curvature flow for entire Lipschitz graphs

Differential Geometry
Géométie differentielle

In this joint work with Jingyi Chen and Weiyong He, we prove existence of longtime smooth solutions to mean curvature flow of entire Lipschitz Lagrangian graphs. We also obtain results on entire translating and self-expanding solutions to the Lagrangian mean curvature flow.

AILANA FRASER, University of British Columbia
[Thursday August 13 / jeudi le 13 août, 14:00 – FSC-1615]
Minimal surfaces, conformal geometry, and the Dirichlet-to-Neumann map

I will talk about joint work with R. Schoen on sharp eigenvalue bounds and minimal surfaces.

GABRIEL RUIZ HERNANDEZ, CIMAT, Jalisco s.n. Col. Valenciana, Guanajuato, Gto
[Thursday August 13 / jeudi le 13 août, 14:30 – FSC-1615]
Higher codimensional Euclidean helix submanifolds

A submanifold of $\mathbb{R}^n$ whose tangent space makes constant angle with a fixed direction d is called a helix. Helix submanifolds are related with the Eikonal PDE equation. We will recall a method to find every solution to the Eikonal PDE on any Riemannian manifold, locally. As a consequence we give a local construction of arbitrary Euclidean helix submanifolds of any dimension and codimension. Also we characterize the ruled helix submanifolds and in particular we describe those which are minimal. Some motivations for the study of helix submanifolds comes from the physics of interfaces of liquid cristals. Part of these ideas have a natural extension when the ambient is a Riemannian manifold that admits a parallel vector field.

The next work was done in collaboration with Antonio Di Scala.

HAYDEÉ HERRERA-GUZMÁN, Rutgers University, Camden, NJ
[Friday August 14 / vendredi le 14 août, 9:30 – FSC-1615]
Complex contact manifolds and S^1 actions

We prove rigidity and vanishing theorems for several holomorphic Euler characteristics on complex contact manifolds admitting holomorphic circle actions preserving the contact structure. Such vanishings are reminiscent of those of LeBrun and Salamon on Fano contact manifolds but under a symmetry assumption instead of a curvature condition.

TOM IVEY, College of Charleston, Charleston, SC, United States
[Friday August 14 / vendredi le 14 août, 14:30 – FSC-1615]
Cable knot solutions of the vortex filament flow

A naïve model of vortex filament motion in an ideal fluid leads to an integrable geometric evolution equation for curves in Euclidean 3-space known as the vortex filament flow (VFF). Solutions of the flow are related to solutions of the cubic focussing nonlinear Schrodinger (NLS) equation via the well-known Hasimoto correspondence. In particular, algebro-geometric techniques for constructing finite-gap NLS solutions can be adapted to generate VFF solutions associated to a given hyperelliptic Riemann surface.

In this talk, I will discuss joint work with Annalisa Calini, describing how to generate a family of closed VFF solutions of increasing topological complexity via successive deformations of the associated Riemann surface. Beginning with a circle, we prove that every step in the deformation sequence corresponds to constructing a cable on previous filament; moreover, the knot type of the filament can be read off from the data generating the deformations.

Differential Geometry
Géométie differentielle

SPIRO KARIGIANNIS, University of Waterloo, Waterloo, ON, Canada
[Friday August 14 / vendredi le 14 août, 10:00 – FSC-1615]
Curvature of the moduli space of G_2 metrics

I will talk about the geometry of the moduli space $\mathcal{M}$ of holonomy G_2 metrics. In particular I will discuss the Hessian metric structure, the Yukawa coupling, and the sectional curvature of this moduli space.

This is a combination of past work with Conan Leung and new work in progress with Christopher Lin.

HUGUES LAPOINTE, Université de Montréal, Département de mathématiques et de statistique
[Saturday August 15 / samedi le 15 août, 9:00 – FSC-1615]
Spectral function of the Laplacian on a Riemannian manifold: dynamical features and average growth

In the talk I will present some recent results on average growth of the spectral function of the Laplacian on a Riemannian manifold, obtained in a joint work with Iosif Polterovich (Université de Montréal) and Yuri Safarov (King's College, London). The link between the asymptotic behaviour of the spectral function and the dynamics of the geodesic flow will be also discussed.

OLAF MULLER, Universidad Nacional Autónoma de México (UNAM), Instituto de Matemáticas, Unidad Morelia, Antigua Carretera a Patzcuaro KM 8, CP 58089 Morelia, Michoacán, México
[Thursday August 13 / jeudi le 13 août, 12:00 – FSC-1615]
Foliations of globally hyperbolic manifolds

In this talk, I will give an overview over recent developments in the theory of Cauchy foliations of globally hyperbolic manifolds. A Cauchy foliation is a one-codimensional foliation whose leaves are Cauchy hypersurfaces. One can ask for additional properties, such like orthogonality of the foliation, or bounds on the characteristic quantities as lapse and shift (or, in geometric terms, gradient of the time function and Weingarten tensor of the Cauchy hypersurfaces). Apart from the obvious relevance of these foliations for the different formulations of the initial value problem in general relativity, I will sketch shortly some applications in the theory of minimal surfaces and in Nash type embedding theorems for Lorentzian manifolds.

ANDRÉS PEDROZA, Universidad de Colima, Facultad de Ciencias, Bernal Díaz del Castillo No. 340, Col. Villas San Sebastián, C.P. 28045, Colima, Colima, México
[Friday August 14 / vendredi le 14 août, 14:00 – FSC-1615]
Seidel's Morphism on the Hamiltonian Group of a Cartesian Product

The Seidel homomorphism is a map from the fundamental group of the group of Hamiltonian diffeomorphisms, $\mathrm{Ham}(M,\omega)$, to the quantum homology ring $QH_*(M\,;\Lambda)$. Using this homomorphism we give a sufficient condition for when a nontrivial loop ψ in $\mathrm{Ham}(M,\omega)$ determines a nontrivial loop $\psi\times \mathrm{id}_N$ in $\mathrm{Ham}(M\times N,\omega\oplus\eta)$, where (N,η) is a closed symplectic manifold such that $\pi_2(N)=0$. Recently, R. Leclercq generalized this result by removing the topological constraint on N.

CATHERINE SEARLE, IMATE–UNAM Cuernavaca
[Thursday August 13 / jeudi le 13 août, 11:00 – FSC-1615]
Non-negatively curved manifolds with maximal symmetry rank

We consider compact, simply-connected, non-negatively curved Riemannian manifolds admitting and isometric torus action. We classify up to diffeomorphism 5-manifolds with maximal and almost maximal symmetry rank and as a result of our work we can show that the maximal symmetry rank for this class of n-manifolds in dimensions less than or equal to 9 is $[\frac{2n}{3}]$, where n is the dimension of the manifold.

This work is joint with Fernando Galaz Garcia.

MCKENZIE WANG, McMaster University, Hamilton, Ontario, Canada
[Thursday August 13 / jeudi le 13 août, 11:30 – FSC-1615]
Examples of Ricci Solitons

A Ricci soliton is a "trivial" solution of Hamilton's Ricci flow, i.e., a solution obtained by a one-parameter family of diffeomorphisms and dilations. Alternatively, a Ricci soliton is a pair (g, X) consisting of a complete Riemannian metric on a manifold M and a vector field X which satisfy the equation

$$\mathrm{Ric}(g) + \frac{1}{2}\mathcal{L}_X g + \epsilon/2 g = 0$$

where $\mathcal{L}$ denotes the Lie derivative and ϵ is a constant. A Ricci soliton is *gradient* if the vector field X is the gradient of a function f. Ricci solitons are clearly generalizations of Einstein metrics. Furthermore, they arise when one considers blow-up limits of the Ricci flow as well as when one considers monotonic quantities along the Ricci flow.

In this talk I will discuss some recent examples of gradient Ricci solitons which were obtained in joint work with Andrew Dancer (Oxford).

GREGOR WEINGART, Instituto de Matemáticas (Cuernavaca), Universidad Nacional Autónoma de México, Avenida Universidad s/n, Colonia Lomas de Chamilpa, 62210 Cuernavaca, Morelos, Mexique
[Saturday August 15 / samedi le 15 août, 9:30 – FSC-1615]
Sectional Curvature Integrals

The sectional curvature of a Riemannian manifold M define a scalar function on the Graßmann-bundle $\mathrm{Gr}_2(TM)$ of 2–planes in TM. The talk will focus on the evaluation of the moments of this function in special examples in order to study the expectation value and the variance of the sectional curvature as well as the variation of the moments under a variation of the Riemannian metric.

Dynamical Systems
Systèmes dynamiques

Org: Florin Diacu (Victoria), **Renato Ituriaga** (CIMAT) and/et **Ernesto Pérez-Chavela** (UAM)

Schedule/Horaire **Room/Salle: FSC-1613**

Thursday August 13 — jeudi 13 août

11:00 - 11:25	Ray McLenaghan, *Symmetry operators for the Dirac equation on 2-dimensional Riemannian spin manifolds*
11:30 - 11:55	Antonio Garcia, *Asymptotic properties of some non-Markovian stochastic processes*
12:00 - 12:25	Joaquin Delgado, *The Bogdanov–Takens bifurcation in a class of traffic flow models*
14:00 - 14:25	Monica Cojocaru, *Hybrid dynamical systems and dynamics of networks and games*
14:30 - 14:55	Aubin Arroyo, *C^2-robustly transitive diffeomorphisms on surfaces with boundary*
15:00 - 15:25	Ernesto Pérez-Chavela, *Central Configurations in the four body problem with some equal masses*

Friday August 14 — vendredi 14 août

9:00 - 9:25	Carlos Villegas, *On the regularization of the Kepler and Coulomb problems*
9:30 - 9:55	Lennard Bakker, *Linear Stability of Some Symmetric Periodic Simultaneous Binary Collision Orbits in the Four-Body Problem*
10:00 - 10:25	Manuele Santoprete, *Toward Bertrand's theorem for surfaces of revolution*
13:30 - 13:55	Cristina Stoica, *Normal forms for Hamiltonian systems with symmetry*
14:00 - 14:25	Alberto Verjovsky, *Holomorphic dynamical systems whose orbit spaces give new examples of compact complex manifolds*
14:30 - 14:55	Florin Diacu, *The n-body problem in spaces of constant curvature*

Saturday August 15 — samedi 15 août

9:00 - 9:25	Adolfo Guillot, *Complex differential equations with single-valued solutions*
9:30 - 9:55	Caroline Adlam, *The equivalence problem for Killing tensors defined on spaces of constant curvature*
10:00 - 10:25	Martin Celli, *Polygonal relative equilibria in the N-vortex problem*
13:30 - 13:55	Renato Iturriaga, *Hyperbolicity and exponential convergence of the Lax Operator*

Abstracts/Résumés

CAROLINE ADLAM, Dalhousie University, Halifax, Nova Scotia
[Saturday August 15 / samedi le 15 août, 9:30 – FSC-1613]

The equivalence problem for Killing tensors defined on spaces of constant curvature

Beginning with the classic 1950 paper by M. N. Olevksii, the study of canonical characteristic Killing tensors of valence two defined on three-dimensional spaces of constant (non-zero) curvature has been thoroughly investigated in the literature. However, there is yet no general theory concerning the solvability of the corresponding equivalence problem.

Thus, we present a solution to the equivalence problem by applying the invariant theory of Killing tensors developed in recent years. In particular, we use the isometry group representation in the vector spaces of Killing two-tensors and apply the resulting invariants and covariants to characterize the orbits corresponding to the characteristic Killing two-tensors.

To illustrate our results, we apply our theory to Hamiltonian systems whose associated Hamilton–Jacobi equation is solvable by orthogonal separation of variables.

Dynamical Systems
Systèmes dynamiques

AUBIN ARROYO, U. Cuernavaca, I. de Matematicas, UNAM
[Thursday August 13 / jeudi le 13 août, 14:30 – FSC-1613]
C^2-robustly transitive diffeomorphisms on surfaces with boundary

Robustly transitive maps can not be ignored in any global picture of dynamical systems. Besides being a property that cannot be destroyed by small perturbations, the maps that have it often exhibit a chaotic dynamical behavior. This property is widely studied in the C^1-topology, and it is related to hyperbolicity and transversality properties. Few things are known in the C^2-topology. In this talk we shall exhibit a class of smooth diffeomorphisms on a compact surface with boundary which are robustly transitive in the C^2-topology but not in the C^1-topology.

LENNARD BAKKER, 346 TMCB, Brigham Young University, Provo, UT 84602, USA
[Friday August 14 / vendredi le 14 août, 9:30 – FSC-1613]
Linear Stability of Some Symmetric Periodic Simultaneous Binary Collision Orbits in the Four-Body Problem

Recently, Roberts developed a method for analyzing the linear stability of time-reversible periodic solutions of a Hamiltonian system. He used this method to determine the linear stability of the figure eight orbit in the equal mass three-body problem. We use Robert's method to determine the linear stability of time-reversible periodic simultaneous binary collision orbits in the symmetric collinear four-body $1, m, m, 1$ problem, and in the two-dimensional symmetric equal mass four-body problem.

MARTIN CELLI, Universidad Autónoma Metropolitana-Iztapalapa, Mexico City
[Saturday August 15 / samedi le 15 août, 10:00 – FSC-1613]
Polygonal relative equilibria in the N-vortex problem

The N-vortex problem consists in the study of the solutions of the equations of Helmholtz which describe the motion of a planar incompressible fluid.

We are interested in relative equilibria made of regular polygons. We show that a relative equilibrium with one polygon with more than three vortices requires equal vorticities. This result is the analogous of Perko–Walter's one in celestial mechanics. We compute the relative equilibria with two polygons and the same vorticity on each polygon. We also study the corresponding restricted problem.

This work adapts and generalizes results of Aref–Van Buren (two polygons with the same vorticity for all the vortices) and Moeckel–Simó (two polygons in celestial mechanics).

This is a joint work with Ernesto Lacomba and Ernesto Pérez-Chavela.

MONICA COJOCARU, University of Guelph, Guelph, ON, N1G 2W1
[Thursday August 13 / jeudi le 13 août, 14:00 – FSC-1613]
Hybrid dynamical systems and dynamics of networks and games

We present a hybrid systems approach to describing the time evolution of a class of network equilibrium problems and noncooperative games. Our method is blends in with previous approaches for studying equilibrium problems, coming from optimization and complementarity problems, but brings new understanding of dynamics for certain classes of equilibrium problems.

This is joint work with Scott Greenhalgh, University of Guelph.

JOAQUIN DELGADO, Departamento de Matemáticas, UAM–Iztapalapa
[Thursday August 13 / jeudi le 13 août, 12:00 – FSC-1613]
The Bogdanov–Takens bifurcation in a class of traffic flow models

Dynamical Systems
Systèmes dynamiques

Macroscopic traffic models are based in the analogy with a continuous 1-dimensional flow. Conservation of number of cars leads to conservation of mass and the Navier–Stokes equation

$$\frac{\partial \rho}{\partial t} + \frac{\partial \rho V}{\partial x} = 0 \tag{1}$$

$$\rho\Big(\frac{\partial V}{\partial t} + V\frac{\partial V}{\partial x}\Big) = \frac{\partial}{\partial x}\Big(\eta\frac{\partial V}{\partial x}\Big) - \frac{\partial p}{\partial x} + X \tag{2}$$

where $\rho(t,x)$ is density, $V(t,x)$ the average velocity of cars, η the "viscosity" and p the local pressure, being proportional to the variance ("temperature") of the traffic $\Theta(x,t)$ and to the gradient velocity; in the simplest case $p = \theta_0\rho - \eta_0\frac{\partial V}{\partial x}$ with constants Θ_0, η_0. The "external forces" in the Kerner–Konhauser are represented by driver's tendency to acquire a safe velocity $V_e(\rho)$ with a relaxation time τ, $X = \rho\frac{V_e(\rho)-V}{\tau}$, where $V_e(\rho)$ is the empirical "fundamental relationship" usually a monotone decreasing function bounded from below.

By performing the change of variables $z = x+v_g t$, solutions of (1) in the form of travelling waves are reduced to: $\rho(v+v_g) = q_g$ with parameters v_g, q_g, and solutions of $(??)$ are reduced to a dynamical system, written in adimensional variables as

$$\begin{aligned} \frac{dv}{dz} &= y \\ \frac{dy}{dz} &= \lambda q_g\Big[1 - \frac{\theta_0}{(v+v_g)^2}\Big]y - \mu q_g\Big(\frac{v_e(v)-v}{v+v_g}\Big). \end{aligned} \tag{3}$$

Here $v_e(v)$ is de adimensional version of $V_e(\rho)$.

We prove that there exist a curve in the parameter space v_g–q_g–Θ_0 such that system (3) undergoes a Bagdanov–Takens bifurcation. In particular we prove the existence of Hopf and homoclinic bifurcations.

This is a joint work with Patricia Saavedra and Rosa María Velasco (UAM–I).

FLORIN DIACU, University of Victoria, PO Box 3060, STN CSC
[Friday August 14 / vendredi le 14 août, 14:30 – FSC-1613]
The n-body problem in spaces of constant curvature

In the 1830s, Bolyai and Lobachevsky independently extended cal 2-body problem to spaces of negative constant curvature. Their work was continued by other mathematicians, including Lipschitz and Killing, who also considered the positive-curvature case. Schroedinger and Infeld later developed a quantum-mechanical analogue. But in spite of many recent results obtained in this direction by the Russian school of celestial mechanics, the problem was never generalized to more than 2 bodies. The goal of this talk is to derive the equations of motion of the n-body problem in spaces of constant curvature and to present some of the interesting properties these equations have. Among them are certain solutions that provide some new criteria towards understanding the large-scale geometry of the physical space.

ANTONIO GARCIA, UAM–IZTAPALAPA
[Thursday August 13 / jeudi le 13 août, 11:30 – FSC-1613]
Asymptotic properties of some non-Markovian stochastic processes

We study the limit behavior of certain classes of dependent random sequences (processes) which do not possess the Markov property. We remark the differences between the Markovian and our problem. Assuming the dependence of the non-Markovian processes depend on a control parameter we show that the optimization of the control can be reduced to a problem of nonlinear optimization. Under certain hypotheses we establish the stability of such optimization problems.

Dynamical Systems
Systèmes dynamiques

ADOLFO GUILLOT, UNAM, Instituto de Matematicas, Cuernavaca
[Saturday August 15 / samedi le 15 août, 9:00 – FSC-1613]
Complex differential equations with single-valued solutions

We will talk about recent work in collaboration with Julio Rebelo dealing with semicomplete meromorphic vector fields on complex surfaces, that is, vector fields whose solutions are single-valued in restriction to the open set where the vector field is holomorphic. We will show that, up to a birational transformation, a compact connected component of the divisor of poles is either a rational or elliptic curve of vanishing self-intersection or has the combinatorics of a singular fiber of an elliptic fibration. This implies that up to a birational transformation, a semicomplete meromorphic vector field on a compact complex projective surface is either holomorphic, has a first integral or preserves a fibration. This extends to semicomplete polynomial vector fields in $\mathbf{C}^2$ the results established by Brunella for complete ones.

RENATO ITURRIAGA, Cimat
[Saturday August 15 / samedi le 15 août, 13:30 – FSC-1613]
Hyperbolicity and exponential convergence of the Lax Operator

The Lax operator gives the solution of the evolution Hamilton–Jacobi equation. It is a result of Fathi that in the Hamiltonian is autonomous the evolution process converges to solution of the static Hamilton–Jacobi equation. We prove that if the Aubry set is hyperbolic this convergence is exponential.

RAY MCLENAGHAN, University of Waterloo, Department of Applied Mathematics, Waterloo, Ontario N2L 3G1
[Thursday August 13 / jeudi le 13 août, 11:00 – FSC-1613]
Symmetry operators for the Dirac equation on 2-dimensional Riemannian spin manifolds

The second-order symmetry operators for the Dirac equation on 2-dimensional Riemannian spin manifolds are determined in terms of Killing vectors and valence two Killing tensors defined on the underlying manifold. The role of these operators in the theory of separation of variables for the Dirac equation is described.

Joint work with Lorenzo Fatibene, Giovanni Rastelli, and Shane Smith.

ERNESTO PÉREZ-CHAVELA, Universidad Autonoma Metropolitana–Iztapalapa, Av. San Rafael Atlixco 186, Mexico, D.F. 09340, Mexico
[Thursday August 13 / jeudi le 13 août, 15:00 – FSC-1613]
Central Configurations in the four body problem with some equal masses

A central configuration in the N-body problem is a particular position of the N-particles where the acceleration vector of each particle is proportional to the corresponding position vector, and the constant of proportionality is the same for the N-particles. In this talk we study the central configurations in the four body problem when three or two of the masses are equal. We prove that there is an unique convex central configurations when two equal masses are located at opposite vertices of a quadrilateral. If three of the masses are equal and the configuration possesses a symmetry line, we find the total number of central configurations.

MANUELE SANTOPRETE, Wilfrid Laurier University
[Friday August 14 / vendredi le 14 août, 10:00 – FSC-1613]
Toward Bertrand's theorem for surfaces of revolution

Dynamical Systems
Systèmes dynamiques

In classical mechanics, Bertrand's theorem states that the only two types of central potentials for which all the bounded orbits are closed are the gravitational potential and the harmonic oscillator potential. In this talk I will consider the motion of a particle on a surface, under the influence of a central force field, and I will discuss Bertrand's theorem in the case of surfaces of revolution. I will present some results and some open questions.

CRISTINA STOICA, Wilfrid Laurier University, 75 Univ. Ave West, Waterloo, ON, N2L 3C5
[Friday August 14 / vendredi le 14 août, 13:30 – FSC-1613]
Normal forms for Hamiltonian systems with symmetry

This talk presents results concerning the Birkhoff normal forms theory for Hamiltonian systems with non-commutative continuous symmetries around a relative equilibrium.

An appropriate slice theorem is used to locally decompose the phase space into the drift and slice directions, that is, coordinates along the symmetry group and complementary directions, respectively. The dynamics is described by a skew product system where the slice dynamics, a Hamiltonian system in the Poisson sense, drives the drift. The normal form for the slice equations is achieved by using structure preserving (Poisson) changes of coordinates. Further, the normalization of the slice equations induces the normalization of the drift equations.

This work is joint with Mark Roberts (Univ. of Surrey, UK) and Tanya Schmah (U of T).

ALBERTO VERJOVSKY, Instituto de Matematicas, Unidad Cuernavaca, Universidad Nacional Autonoma de Mexico
[Friday August 14 / vendredi le 14 août, 14:00 – FSC-1613]
Holomorphic dynamical systems whose orbit spaces give new examples of compact complex manifolds

We consider in $\mathbb{C}^n$ a system of m commuting linear ODE ($2m+1<n$) given by m commuting matrices $A_1,\ldots,A_m$. Under some generic and arithmetic conditions, the (semi-stable) orbit spaces of the $\mathbb{C}^m\times\mathbb{C}^*$ action generated by the commmuting equations, together with the action of multiplication of scalars in $\mathbb{C}^*$, give compact, complex manifolds that fiber over toric varieties. We indicate the proof that every nonsingular toric variety is obtained this way.

In this talk I will describe joint work with Laurent Meersseman.

CARLOS VILLEGAS, Universidad Nacional Autonoma de Mexico, Avenida Universidad S/N, Col. Lomas de Chamilpa, Cuernavaca Morelos, 62210, MEXICO
[Friday August 14 / vendredi le 14 août, 9:00 – FSC-1613]
On the regularization of the Kepler and Coulomb problems

We describe two known regularizations of the Kepler problem: The Moser and the Kustaanheimo–Stiefel regularizations. By considering the quantization of a canonical transformation relating both regularizations, we define a Bargmann-type transform and as a consequenece a set of coherent states for the Hilbert space of square integrable functions on the 3-sphere and the hydrogen atom problem with negative energy. We describe asymptotics for clusters of eigenvalues for suitable perturbations of the hydrogen atom problem. We will describe the geometry of the above-mentioned canonical transformation involving two moment maps of related Lie groups.

Optimization and Approximation
Optimisation et approximation

Org: Michael Friedlander (UBC), **Pedro González-Casanova** (DGSCA: UNAM) and/et **Luis Verde-Star** (UAM-Iztapalapa)

Schedule/Horaire **Room/Salle: FSC-1001**

Thursday August 13 — jeudi 13 août

11:30 - 11:55	Rafael G. Campos
12:00 - 12:25	Pedro González-Casanova, *Vector field approximation using radial basis functions*
14:00 - 14:25	Michael Friedlander, *Spot: A linear-operator toolbox for Matlab*
14:30 - 14:55	Jane Ye, *Optimizing condition numbers*
15:00 - 15:25	Dominique P. Orban, *An Interior-Penalty Method for Mathematical Programs with Vanishing Constraints*

Friday August 14 — vendredi 14 août

9:00 - 9:25	Michael L. Overton, *Nonsmooth Optimization via BFGS*
9:30 - 9:55	Jan Modersitzki, *Numerical Methods for Total Variation in Image Processing*
10:00 - 10:25	Shawn Wang, *Resolvent Averages of Monotone Operators*
13:30 - 13:55	Susana Gómez, *Modeling the Optimal Cleaning of Polluting Oil in the Open Sea*

Saturday August 15 — samedi 15 août

9:00 - 9:25	José Luis Martínez-Morales, *Approximation by Penalized Least Squares*
9:30 - 9:55	Javier F. Rosenblueth, *Approximation of Lagrange Multipliers in Optimal Control*
10:00 - 10:25	Luis Verde-Star, *Computation of Hermite–Pade interpolants by iterated polynomial interpolation*
13:30 - 13:55	Heinz Bauschke, *Chebyshev and Klee sets with respect to Bregman distances*
14:00 - 14:25	Michael Saunders, *QPBLUR: An active-set convex QP solver based on regularized KKT systems*
14:30 - 14:55	Yuriy Zinchenko, *Shrink-wrapping trajectories for linear programming*

Abstracts/Résumés

HEINZ BAUSCHKE, University of British Columbia Okanagan

[Saturday August 15 / samedi le 15 août, 13:30 – FSC-1001]

Chebyshev and Klee sets with respect to Bregman distances

A set is called Chebyshev if every point has a unique nearest point in it. It is well known that—in Euclidean space—a set is Chebyshev if and only if it is closed, convex and nonempty. The corresponding Hilbert space question remains a famous open problem. Most studies have focused on obtaining results in general Banach space, under additional assumptions on the Chebyshev set.

A related question—again open in Hilbert space—concerns Klee sets and farthest points, which turn out to be singletons in Euclidean space.

In this talk, I will survey recent results on Chebyshev and Klee sets that revisit these questions from a new perspective: rather than working with a distance induced by a Banach space norm, we consider the Bregman distance induced by a well-behaved convex function.

Based on joint works with Mason Mackelm (UBCO), Jason Sewell (UBCO), Shawn Wang (UBCO), Jane Ye (UVic), Xiaoming Yuan (Hong Kong Baptist University).

Optimization and Approximation
Optimisation et approximation

RAFAEL G. CAMPOS, Univ. Michoacana - Morelia
[Thursday August 13 / jeudi le 13 août, 11:30 – FSC-1001]

MICHAEL FRIEDLANDER, University of British Columbia, Vancouver, BC
[Thursday August 13 / jeudi le 13 août, 14:00 – FSC-1001]
Spot: A linear-operator toolbox for Matlab

Linear operators are at the core of many of the most basic algorithms for signal and image processing. Matlab's high-level, matrix-based language allows us to express naturally many of the underlying matrix operations—e.g., computation of matrix-vector products and manipulation of matrices—and is thus a powerful platform on which to develop concrete implementations of these algorithms. Many of the most useful operators, however, do not lend themselves to the explicit matrix representations that Matlab provides. This talk describes the new Spot Toolbox, which aims to bring the expressiveness of Matlab's built-in matrix notation to problems for which explicit matrices are not practical. I will demonstrate features of the toolbox with examples from compressed sensing and image reconstruction.

This is joint work with Ewout van den Berg.

PEDRO GONZÁLEZ-CASANOVA, Universidad Nacional Autonoma de Mexico
[Thursday August 13 / jeudi le 13 août, 12:00 – FSC-1001]
Vector field approximation using radial basis functions

Approximation of vector fields from a set of scattered vector data by radial basis functions interpolation methods, have a wide applicability to different fields, like meteorology, fluid mechanics and elasticity. Within the last years, several authors have formulated and analyzed different RBFs interpolation techniques to solve this kind of problems. A major limitation, from the applied point of view, is that these meshfree interpolants have been built by minimizing some particular energy functional defined R^n. Thus in general, no boundary conditions can be incorporated into these numerical approximations. In this talk by using a rather different approach, based on a Lagrange multipliers technique, we present a solution to this problem within the context of RBFs methods. Numerical examples, based on multiquadric kernels, applied to atmospheric reconstruction fields will be presented.

Joint work with D. Cervantes and C. Gout.

SUSANA GÓMEZ, National University of Mexico, Mexico City
[Friday August 14 / vendredi le 14 août, 13:30 – FSC-1001]
Modeling the Optimal Cleaning of Polluting Oil in the Open Sea

In this ongoing work, a model of the movement of oil spots in the open sea and the numerical methods to solve the resulting partial differential equations, implemented on a distributed parallel machine, are presented. The model includes the effect of a Pumping Ship, that aspires the polluting oil.

The ship will follow a global optimal trajectory, that maximizes the amount of pollutant pumped. The global optimization will be carried out using a fast evolutionary algorithm. Numerical results will be presented.

JOSÉ LUIS MARTÍNEZ-MORALES, Universidad Nacional Autonoma de Mexico, A.P. 273, Admon. de correos #3 C.P. 62251 Cuernavaca, Mor., Mexico
[Saturday August 15 / samedi le 15 août, 9:00 – FSC-1001]
Approximation by Penalized Least Squares

Optimization and Approximation
Optimisation et approximation

Consider a compact Riemannian manifold and a set of scattered points lying on it. In this talk we are interested in the following problem.

Problem: Given vectors $\mathbf{x}_1, \ldots, \mathbf{x}_p$, find a vector-valued function defined on the manifold which approximates the data

$$f(x_i) \approx \mathbf{x}_i.$$

JAN MODERSITZKI, McMaster University
[Friday August 14 / vendredi le 14 août, 9:30 – FSC-1001]
Numerical Methods for Total Variation in Image Processing

Starting with the outstanding paper of Rudin, Osher, and Fatemi from 1992, total variation has become a versatile and powerful tool in modern image processing. Despite its popularity, a numerical treatment of total variation is not straightforward and many publications address this problem from various perspectives.

This presentation aims to introduce to numerical schemes for total variation and ways to bypass difficulties arising from the none differentiability of total variation. To keep the focus clear and concrete, image denoising serves as a template problem. The starting point is the minimization of joined energy functional, composed from a simple L_2-norm based data fitting term and a total variation based regularizer.

Moreover, the presentation summarizes, discusses, and relates popular approaches such as the naive primal, a dual approach of Vogel, the split Bregman method of Goldstein and Osher, and the augmented Lagrangian approach of Tai and Wu. As the starting point is a variational framework, emphasis is also given to alternative perspectives for a numerical treatment such as the optimize then discretize and discretize then optimize approaches.

DOMINIQUE P. ORBAN, GERAD and École Polytechnique, Montréal
[Thursday August 13 / jeudi le 13 août, 15:00 – FSC-1001]
An Interior-Penalty Method for Mathematical Programs with Vanishing Constraints

MPVCs are degenerate nonlinear programs that model topology and structural optimization problems. They resemble problems with complementarity constraints yet different sets of qualification conditions are used to formulate necessary optimality conditions. We extend a mixed interior/exterior elastic penalty method to MPVCs. Global and fast local convergence are established. We illustrate our algorithm on instances of structural problems.

MICHAEL L. OVERTON, Courant Institute, New York University, New York, NY
[Friday August 14 / vendredi le 14 août, 9:00 – FSC-1001]
Nonsmooth Optimization via BFGS

The BFGS algorithm has long been recognized as one of the most useful algorithms for minimization of a smooth function f, convex or not. We investigate the behavior of the BFGS algorithm, both theoretically and experimentally, when it is applied to a nonsmooth function f, not necessarily convex.

Joint work with Adrian Lewis.

JAVIER F. ROSENBLUETH, Universidad Nacional Autónoma de México, IIMAS, Apartado Postal 20-726, México DF 01000
[Saturday August 15 / samedi le 15 août, 9:30 – FSC-1001]
Approximation of Lagrange Multipliers in Optimal Control

Optimization and Approximation
Optimisation et approximation

Almost thirty years ago, Hestenes wrote that the concept of augmentability had not received the attention that it deserves in the development of optimization theory. This notion leads to the method of multipliers, and its significance in the development of computational procedures has been recognized (some variants have been used, for example, in convex programming). Moreover, it is well-known that the Lagrange multiplier rule for equality and inequality constraints is a consequence of augmentability, and augmentability is a consequence of the strengthened Lagrange multiplier rule. Let us point out that it is simpler to derive the first-order and second-order Lagrange multiplier rule under an assumption of augmentability than under the assumption of regularity usually used.

However, despite the clear explanation given in several papers by that author of different types of augmentability and some of their consequences, this concept has still received very little interest in certain areas of optimization theory. In this talk we intend to call attention to the role played by that concept, not only in the derivation of necessary conditions for constrained minimum problems and in finding numerical solutions, but also in possible extensions to infinite dimensional problems. In particular, we shall show how a certain method of multipliers can be introduced to solve optimal control problems involving mixed equality constraints.

MICHAEL SAUNDERS, Stanford University, California
[Saturday August 15 / samedi le 15 août, 14:00 – FSC-1001]
QPBLUR: An active-set convex QP solver based on regularized KKT systems

SNOPT obtains search directions from semidefinite QP subproblems, which are currently solved by SQOPT. For large problems with many degrees of freedom, the nullspace active-set method of SQOPT becomes inefficient.

QPBLUR is an alternative convex QP solver intended for use within SNOPT. It uses primal and dual regularization to ensure that the KKT system for any active set is nonsingular. A single-phase active-set method becomes possible. Warm starts can proceed from any given active set, and block-LU updates of the KKT factors as in QPBLU (Hanh Huynh's PhD dissertation, 2008) allow use of sparse-matrix packages such as LUSOL, MA57, PARDISO, SuperLU, or UMFPACK.

Joint work with Chris Maes, iCME, Stanford University.

LUIS VERDE-STAR, Universidad Autonoma Metropolitana, Mexico City
[Saturday August 15 / samedi le 15 août, 10:00 – FSC-1001]
Computation of Hermite–Pade interpolants by iterated polynomial interpolation

Let I be an open interval and $f\colon I \to \mathbb{R}$ a sufficiently differentiable function such that $f(x) \neq 0$ for $x \in I$. Suppose that $u_0, u_1, u_2, \ldots$ is a sequence of monic polynomials such that for $k \geq 0$ we have that u_k divides u_{k+1} and has all its roots in I.

If g is a sufficiently differentiable function defined on I, we denote by $H(g, u_k)$ the polynomial of smallest degree that interpolates g at the multiset of roots of u_k in the sense of Hermite.

We construct a sequence of polynomials $p_0, p_1, p_2, \ldots$ defined as follows:

$$p_0 = H(f, u_0), \quad p_1 = H(p_0/f, u_1),$$
$$\text{for } k \text{ even} \quad p_k = H(f\, p_{k-1}, u_k), \text{ and}$$
$$\text{for } k \text{ odd} \quad p_k = H(p_{k-1}/f, u_k).$$

We show that for each even integer k the rational function p_k/p_{k+1} is a Hermite–Padé interpolant for f at the multiset of roots of u_k. We present some examples and numerical results. We also consider some particular choices for the sequence u_k and indicate some possible modifications of our construction.

SHAWN WANG, University of British Columbia Okanagan, Kelowna, BC Canada
[Friday August 14 / vendredi le 14 août, 10:00 – FSC-1001]
Resolvent Averages of Monotone Operators

Optimization and Approximation
Optimisation et approximation

Monotone operators play important roles in optimization and convex analysis. We define a new average of monotone operators by using resolvents. The new average enjoys self-duality. When the monotone operators are positive definite matrices, the new average lies between harmonic average and arithmetic average. Proximal average will also be discussed.

This is a joint work with Heinz Bauschke and Sarah Moffit.

JANE YE, Department of Mathematics and Statistics, University of Victoria
[Thursday August 13 / jeudi le 13 août, 14:30 – FSC-1001]
Optimizing condition numbers

In this talk we consider the problem of minimizing condition numbers over a compact convex subset of the cone of symmetric positive semi-definite $n \times n$ matrices. We show that the condition number is a Clarke regular strongly pseudoconvex function. We prove that a global solution of the problem can be approximated by an exact or an inexact solution of a nonsmooth convex program. This asymptotic analysis provides a valuable tool for designing an implementable algorithm for solving the problem of minimizing condition numbers.

YURIY ZINCHENKO, University of Calgary, MS446, 2500 University Drive NW, Calgary, Alberta, Canada, T2N 1N4
[Saturday August 15 / samedi le 15 août, 14:30 – FSC-1001]
Shrink-wrapping trajectories for linear programming

Hyperbolic Programming (HP)—minimizing a linear functional over an affine subspace of a real vector space intersected with hyperbolicity cone—is a class of convex optimization problems that contains Linear Programming (LP). For any LP one can readily provide a sequence of HP relaxations. Based on the hyperbolic relaxations, a new Shrink-Wrapping approach to solve LP has been proposed by Renegar. We study the geometry of Shrink-Wrapping trajectories for LP, which generalize the notion of central path in IPM. In particular, we analyze the geometry of these trajectories in the proximity of the so-called central line, and contrast the behavior of these trajectories with that of the central path for some pathological LP instances.

Partial Differential Equations
Equations aux dérivées partielles

Org: Monica Clapp (UNAM), **Nassif Ghoussoub** (UBC) and/et **Pablo Padilla** (UNAM)

Schedule/Horaire **Room/Salle: FSC-1005**

Thursday August 13 — jeudi 13 août

14:00 - 14:25	David Costa, *Sharp Constants and Minimizers for a Class of Inequalities*
14:30 - 14:55	Amir Moradifam, *Bessel pairs and optimal Hardy and Hardy–Rellich inequalities*
15:00 - 15:25	Carlos García-Azpeitia, *Applications of the ortogonal degree to the problem of bifurcation in Hamiltonian dynamical systems*

Friday August 14 — vendredi 14 août

9:00 - 9:25	Nils Ackermann, *Alternating sign multibump solutions of nonlinear elliptic PDEs in expanding tubular domains*
9:30 - 9:55	Carlos Vélez, *Existence of sign-changing solutions for resonant and non-resonant semilinear elliptic problems*
10:00 - 10:25	Ramón Zárate, *Inverse problems via variational methods.*
13:30 - 13:55	Mauricio Labadie, *A reaction-diffusion model for calcium in neurons*
14:00 - 14:25	Craig Cowan, *A fourth order equation modelling a simple MEMS device*
14:30 - 14:55	Antonio Capella-Kort, *On a perturbation of the linearized two dimensional two-well problem*

Saturday August 15 — samedi 15 août

9:00 - 9:25	Panayotis Panayotaros, *Continuation of breathers in a finite discrete NLS lattice*
9:30 - 9:55	Alip Mohammed, *Poisson equation with the Robin boundary condition*
10:00 - 10:25	Ibrahim Slim, *A direct proof of the energy exponential decay of the damped NLKG equation*
13:30 - 13:55	Gabriel López-Garza, *Existence and Multiplicity for a Resonance Problem for the p-Laplacian*
14:00 - 14:25	Abbas Momeni, *A variational principle associated with a certain class of boundary value problems*

Abstracts/Résumés

NILS ACKERMANN, UNAM, Circuito Exterior, CU, México, D.F., C.P. 04510
[Friday August 14 / vendredi le 14 août, 9:00 – FSC-1005]
Alternating sign multibump solutions of nonlinear elliptic PDEs in expanding tubular domains

Let Γ denote the image of a smooth embedding of the circle S^1 in $\mathbb{R}^N$, $N \geq 2$. Denote by Ω_R the open normal tubular neighborhood of $R\Gamma$ of radius 1. Consider the superlinear problem $-\Delta u = f(u)$ on the expanding domains Ω_R (i.e., as $R \to \infty$) with homogeneous Dirichlet boundary conditions. We prove the existence of multibump solutions with bumps lined up along $R\Gamma$ and with alternating signs. Here we allow nonodd functions f.

ANTONIO CAPELLA-KORT, Universidad Nacional Autonoma de Mexico
[Friday August 14 / vendredi le 14 août, 14:30 – FSC-1005]
On a perturbation of the linearized two dimensional two-well problem

The two dimensional two-well problem arises in the study of the zero energy states of a solid-solid phase transition in materials that exhibit the so-called shape memory effect.

This problem can be formulated as follows: find $u\colon \Omega \to \mathbb{R}^3$ such that

$$\nabla u \in K = \mathrm{SO}(2)U_a \cup \mathrm{SO}(2)U_b, \quad \text{a.e. in } \Omega, \tag{1}$$

where U_a and U_b are two traceless symmetric matrices, and $\mathrm{SO}(2)$ represents the set of proper rotations. The most simple nontrivial solution to (1) is given by the so-called simple laminates, that is, the function u depends only on one cartesian coordinate. In fact, it was show by Dolzmann and Muller that if the perimeter of the transitions is finite, u has to be simple laminate.

For a suitable energy and in the proper regime, we show that the nonzero energy states for the linearized version of (1), are also closed to a simple laminate.

DAVID COSTA, University of Nevada Las Vegas, 4505 Maryland Pkwy, Box 454020, Las Vegas, NV 89154-4020, USA
[Thursday August 13 / jeudi le 13 août, 14:00 – FSC-1005]
Sharp Constants and Minimizers for a Class of Inequalities

We consider a class of Caffarelli–Kohn–Nirenberg inequalities without restricting the pertinent parameters and determine the values of the optimal constants and the functions that achieve them, i.e., minimizers of a suitable functional. By studying a corresponding Euler–Lagrange equation, we also find infinitely many sign-changing solutions at higher energy levels in addition to the ground-state solutions.

CRAIG COWAN, University of British Columbia, Vancouver, BC
[Friday August 14 / vendredi le 14 août, 14:00 – FSC-1005]
A fourth order equation modelling a simple MEMS device

We examine the equation

$$\Delta^2 u = \frac{\lambda}{(1-u)^2} \quad \text{in B},$$

with zero Dirichlet boundary conditions where B is the unit ball in $\mathbb{R}^N$ and where $\lambda > 0$ is a parameter. We show that the *extremal solution*, u^*, is smooth provided $N \leq 8$ and singular for $N \geq 9$.

This equation is of practical interest since it is the steady state of an equation modeling a simple Micro-Electro-Mechanical System (MEMS) device.

CARLOS GARCÍA-AZPEITIA, Depto. Matemáticas y Mecánica, IIMAS–UNAM, Apado. Postal 20-276 01000, México DF
[Thursday August 13 / jeudi le 13 août, 15:00 – FSC-1005]
Applications of the ortogonal degree to the problem of bifurcation in Hamiltonian dynamical systems

We investigate the bifurcation of periodic solutions from relative equilibria, examples being the n body problem or the n vortex problem. We use the approach of orthogonal degree theory, which lets us probe the existence of global symmetric branches of periodic solutions. We particularly report a general result of bifurcation on the equation of a satellite influenced by a relative equilibria of primaries. We will discuss further the case in which the primaries form a $1+n$-gon, like the Maxwell model for the Saturn rings. We also discuss the case of Halo orbits in the restricted tree body problem.

MAURICIO LABADIE, University of Paris VI
[Friday August 14 / vendredi le 14 août, 13:30 – FSC-1005]
A reaction-diffusion model for calcium in neurons

Partial Differential Equations
Equations aux dérivées partielles

The concentration of calcium ions inside dendritic spines (microstructures of the neuron) plays a crucial role in the synaptic plasticity, and in consequence in cognitive processes like learning and memory. We construct a reaction-diffusion system that models the dynamics of calcium ions in the spine, taking into account the chemical interactions between the calcium ions and three different types of proteins. We prove that this system is a well-posed problem, i.e., we have a priori estimates, global existence, global uniqueness, positivity of solutions and continuity with respect of the initial data.

This result will appear in the article of Kamel Hamdache and Mauricio Labadie, *On a reaction-diffusion model for calcium dynamics in dendritic spines*, Nonlinear Analysis: Real World Applications **10**(2009), 2478–2492 (August issue). This article has been published online on May 2008 (doi: 10.1016/j.nonrwa.2008.05.005).

GABRIEL LÓPEZ-GARZA, Universidad Autónoma Metropolitana, Mexico DF
[Saturday August 15 / samedi le 15 août, 13:30 – FSC-1005]
Existence and Multiplicity for a Resonance Problem for the p-Laplacian

The existence of at least two solutions for a resonance problem involving the p-Laplacian is shown for the case of bounded domains in $\mathbb{R}^N$. This work constitutes an extension of a previous result of Landesman, Robinson and Rumbos for the case $p = 2$ (*Nonlinear Analysis TMA* **24**(1995), 1049–1059).

ALIP MOHAMMED, York University
[Saturday August 15 / samedi le 15 août, 9:30 – FSC-1005]
Poisson equation with the Robin boundary condition

The inhomogeneous Robin/third boundary condition with general coefficient for the Poisson equation on the unit disc is studied in terms of holomorphic functions using Fourier analysis. It is shown that against the usual expectations this problem cannot have a unique solution unless the coefficient of the first order term in the boundary condition is a constant. For the case of general coefficient, it is actually a problem with essential singularity in the domain, but still well-posed under proper assumptions and the unique solution is given explicitly.

ABBAS MOMENI, Queen's University
[Saturday August 15 / samedi le 15 août, 14:00 – FSC-1005]
A variational principle associated with a certain class of boundary value problems

A variational principle is introduced to provide a new formulation and resolution for several boundary value problems. Indeed, we consider systems of the form

$$\begin{cases} \Lambda u = \nabla \Phi(u), \\ \beta_2 u = \nabla \Psi(\beta_1 u) \end{cases}$$

where Φ and Ψ are two convex functions and Λ is a possibly unbounded self-adjoint operator modulo the boundary operator $\mathcal{B} = (\beta_1, \beta_2)$. We shall show that solutions of the above system coincide with critical points of the functional

$$I(u) = \Phi^*(\Lambda u) - \Phi(u) + \Psi^*(\beta_2 u) - \Psi(\beta_1 u)$$

where Φ^* and Ψ^* are Fenchel–Legendre dual of Φ and Ψ respectively. Note that the standard Euler–Lagrange functional corresponding to the system above is of the form,

$$F(u) = \frac{1}{2}\langle \Lambda u, u\rangle - \Phi(u) - \Psi(\beta_1 u).$$

An immediate advantage of using the functional I instead of F, is to obtain more regular solutions and also the flexibility to handle boundary value problems with nonlinear boundary conditions. Applications to Hamiltonian systems and semi-linear elliptic equations with various linear and nonlinear boundary conditions are also provided.

Partial Differential Equations
Equations aux dérivées partielles

AMIR MORADIFAM, University of British Columbia
[Thursday August 13 / jeudi le 13 août, 14:30 – FSC-1005]
Bessel pairs and optimal Hardy and Hardy–Rellich inequalities

We give necessary and sufficient conditions on a pair of positive radial functions V and W on a ball B of radius R in R^n, $n \geq 1$, so that the following inequalities hold for all $u \in C_0^\infty(B)$:

$$\int_B V(x)|\nabla u|^2\,dx \geq \int_B W(x)u^2\,dx,$$

and

$$\int_B V(x)|\Delta u|^2\,dx \geq \int_B W(x)|\nabla u|^2\,dx + (n-1)\int_B \Big(\frac{V(x)}{|x|^2} - \frac{V_r(|x|)}{|x|}\Big)|\nabla u|^2\,dx.$$

This characterization makes a very useful connection between Hardy-type inequalities and the oscillatory behaviour of certain ordinary differential equations, and helps in the identification of a large number of such couples (V, W)—that we call Bessel pairs—as well as the best constants in the corresponding inequalities. This allows us to improve, extend, and unify many results—old and new—about Hardy and Hardy–Rellich type inequalities, such as those obtained by Caffarelli–Kohn–Nirenberg, Brezis–Vázquez, Wang–Willem, Adimurthi–Chaudhuri–Ramaswamy, Filippas–Tertikas, Adimurthi–Grossi–Santra, Tertikas–Zographopoulos, and Blanchet–Bonforte–Dolbeault–Grillo–Vasquez. As an application we give a mathematical proof for the singularity of the extremal solution of the bilaplacian with exponential nonlinearity in dimensions $N \geq 13$.

PANAYOTIS PANAYOTAROS, UNAM
[Saturday August 15 / samedi le 15 août, 9:00 – FSC-1005]
Continuation of breathers in a finite discrete NLS lattice

We present some preliminary results on the continuation and bifurcations of breathers in the discrete NLS in a finite one-dimensional lattice. We show numerical evidence for fold and pitchfork bifurcations as the intesite coupling increases and also discuss breathers that can be continued to normal modes of the weakly linear system.

IBRAHIM SLIM, University of Victoria
[Saturday August 15 / samedi le 15 août, 10:00 – FSC-1005]
A direct proof of the energy exponential decay of the damped NLKG equation

We are interested in proving the exponential decay of the total energy for a damped nonlinear Klein–Gordon equation on R^N, $N \geq 2$. Such a result is already known, in the defocusing case, for energy subcritical nonlinearities. The restrictions to this type of nonlinearity are mainly due to the use of unique continuation and linear approximation arguments. We propose a direct approach based solely on Morawetz-type a priori estimates. It applies to the energy critical case, including exponential nonlinearities in dimension two, and also to the supercritical case, as long as the solution remains regular. We can also treat the focusing case once we have control of the nonlinear part in Morawetz-type estimates. In particular this can be achieved when we know the scattering for the undamped equation.

This is joint work with Lassaad Aloui and Kenji Nakanishi.

CARLOS VÉLEZ, Universidad Nacional de Colombia–Sede Medellín
[Friday August 14 / vendredi le 14 août, 9:30 – FSC-1005]
Existence of sign-changing solutions for resonant and non-resonant semilinear elliptic problems

Partial Differential Equations
Equations aux dérivées partielles

In this talk we briefly present recent results regarding the existence of sign-changing solutions of the semilinear elliptic problem

$$\begin{cases} \Delta u + f(u) = 0 \text{ in } \Omega, \\ u = 0 \text{ on } \partial\Omega, \end{cases} \tag{1}$$

where $\Omega \subset \mathbb{R}^N$ is a smooth bounded domain and $f\colon \mathbb{R} \to \mathbb{R}$ is a nonlinear C^1-function which is also *asymptotically linear*, i.e.,

$$\lim_{|t|\to\infty} f'(t) \in \mathbb{R}. \tag{2}$$

Our results rely on two main tools: first, a precise *a priori* estimate for signed-solutions of (1). Second, an abstract Lyapunov–Schmidt reduction method, which allows us to get solutions with relatively large augmented Morse indexes. These tools are applicable to both resonant and non-resonant cases.

The most of these developments are a joint work with Alfonso Castro and Jorge Cossio.

RAMÓN ZÁRATE, UBC

[Friday August 14 / vendredi le 14 août, 10:00 – FSC-1005]

Inverse problems via variational methods.

We present a general variational method for recovering non-linearities from prescribed solutions for certain types of PDEs which are not necessarily of Euler–Lagrange type, including parabolic equations. The approach can be used for optimal control problems.

Probability
Probabilité

Org: Ana Meda (UNAM) and/et **Ed Perkins** (UBC)

Schedule/Horaire **Room/Salle: FSC 1221**

Thursday August 13 — jeudi 13 août

11:00 - 11:25	Jorge Garcia, *Uniform Exponential Tighness Vs. Exponential Stochastic Boundedness*
11:30 - 11:55	Deniz Sezer, *Conditioning Super-Brownian Motion on its boundary statistics and a class of "weakly" extreme X-harmonic functions*
12:00 - 12:25	John Walsh, *The Roughness and Smoothness of Numerical Solutions to the Stochastic Heat Equation*
14:00 - 14:25	Begoña Fernández, *Estimates for the Probability Itô Processes Remain Around a Curve, and Applications to Finance*
14:30 - 14:55	Daniel Hernández-Hernández, *Robust utility maximization in a financial market with prices driven by Lévy processes: A dual approach*

Friday August 14 — vendredi 14 août

9:00 - 9:25	Julio César García-Corte, *Invariant States of the Asymmetric Exclusion Quantum Dynamical Semigroup*
9:30 - 9:55	Christine Soteros, *Knotting Probability for Stretched Polygons in a Lattice Tube*
10:00 - 10:25	Robert Masson, *Second moment estimates for the growth exponent of planar loop-erased random walk*
13:30 - 13:55	José María González-Barrios, *Associativity and Symmetry of Copulas*
14:00 - 14:25	Alexander Holroyd, *Finitary Colouring*
14:30 - 14:55	Onésimo Hernández-Lerma, *Stochastic Control Systems with Long-Run Average Criteria*

Saturday August 15 — samedi 15 août

9:00 - 9:25	Martin Barlow, *Invariance principles for the random conductance model*
9:30 - 9:55	Jeremy Quastel, *Scaling exponent of KPZ*

Abstracts/Résumés

MARTIN BARLOW, University of British Columbia, Vancouver, BC. Canada

[Saturday August 15 / samedi le 15 août, 9:00 – FSC 1221]

Invariance principles for the random conductance model

The Random Conductance Model (RCM) is a model of a reversible or symmetric random walk in a random environment. i.i.d. weights μ_e are assigned to the edges in $\mathbb{Z}^d$. A random walk X is then run, which makes its jumps with probabilities proportional to the edge weights.

This model is now quite well understood in the special cases when either the law of μ_e is concentrated on $[0,1]$ or $1,\infty)$. I will discuss what happens in these cases, and in particular in the case when $E(\mu_e)=\infty$.

BEGOÑIA FERNÁNDEZ, Universidad Nacional Autónoma de México

[Thursday August 13 / jeudi le 13 août, 14:00 – FSC 1221]

Estimates for the Probability Itô Processes Remain Around a Curve, and Applications to Finance

We consider a Brownian Motion $W=(W^i)_{i\in N}$ and an adapted process of dimension n $(X_t)_{t\geq 0}$. We define $\tau_R=\inf\{t: |X_t-x_t|\geq R_t\}$, where x_t, $t\geq 0$ is a deterministic differentiable curve in R^n and $R_t>0$, $t\geq 0$ a ratio that depends on time.

Assume that until τ_R the process X is a solution of the equation

$$X_{t\wedge\tau_R} = x + \sum_{j=1}^{\infty} \int_0^{t\wedge\tau_R} \sigma_j(s,\omega,X_s)\, dW_s^j + \int_0^{t\wedge\tau_R} b(s,\omega,X_s)\, ds,$$

where the coefficients σ_j and b are adapted, locally bounded and $(t,x) \to \sigma_j(t,\omega,x)$ are Lipschitz continuous and satisfy

$$\gamma_t \geq \sigma\sigma^*(t\wedge\tau_R,\omega,X_{t\wedge\tau_R}) \geq \lambda_t.$$

We obtain lower bounds of the form:

$$\exp\left[-Q_n^1\left(1+\int_0^{T+r} F_x^1(t)\, dt\right)\right] \leq P(\tau_R > T) \tag{1}$$

where Q_n^1 is a constant and F_x^1 is a function that depends on x_t and R_t.

We apply the results to obtain lower bounds for option prices for stochastic volatility models.

Joint work with V. Bally and A. Meda.

JORGE GARCIA, California State University Channel Islands

[Thursday August 13 / jeudi le 13 août, 11:00 – FSC 1221]

Uniform Exponential Tighness Vs. Exponential Stochastic Boundedness

In this talk some of the main parallels between weak convergence and large deviations will be explained, particularly, weak convergence of stochastic integrals (in the sense of Kurtz–Protter) and large deviations for sequences of stochastic integrals. Conditions will be given under which a sequence of stochastic processes (X_n, Y_n) implies large deviations for $\int X_n\, dY_n$.

JULIO CÉSAR GARCÍA-CORTE, Universidad Autonoma Metropolitana, Iztapalapa

[Friday August 14 / vendredi le 14 août, 9:00 – FSC 1221]

Invariant States of the Asymmetric Exclusion Quantum Dynamical Semigroup

In this talk we present the qualitative properties of the Asymmetric Exclusion Quantum Dynamical Semigroup: its qualitative properties, their invariant states, convergence to the equilibrium, and characterization of the domain attractions of each of the invariant states.

This is a joint work with Roberto Quezada Batalla and Lepoldo Pantaleon Martinez.

JOSÉ MARÍA GONZÁLEZ-BARRIOS, Universidad Nacional Autonoma de Mexico, IIMAS, Circuito Escolar s/n, Mexico D.F. 04510, Mexico

[Friday August 14 / vendredi le 14 août, 13:30 – FSC 1221]

Associativity and Symmetry of Copulas

In this talk we will introduce two new statistics A_π^n and T_n defined for random samples of size n, of a pair of continuous random variable (X,Y) with copula C. The statistics measure the associativity and symmetry of the samples respectively, that is, if the copula satisfies

$$C\big(x, C(y,z)\big) = C\big(C(x,y), z\big) \quad \text{for every } x,y,z \in [0,1]$$

and

$$C(x,y) = C(y,x) \quad \text{for every } x,y \in [0,1].$$

These conditions are necessary for the copula C to belong to the Archimedean family.

We will study the properties of the new statistics, and we will include some applications.

Probability
Probabilité

DANIEL HERNÁNDEZ-HERNÁNDEZ, CIMAT

[Thursday August 13 / jeudi le 13 août, 14:30 – FSC 1221]

Robust utility maximization in a financial market with prices driven by Lévy processes: A dual approach

We deal with the dynamic maximization of a robust utility function which penalize the possible probabilistic models. The context will be of a market model with prices determined by an external factor which is driven by a Lévy stochastic integral. We characterize first the classes of measures (densities) related to such a market. Once it is established the relation of the penalty associated to the utility function with a convex risk measure, we are able to use duality theory recently developed for an optimal investment in an risk and ambiguity averse setting.

ONÉSIMO HERNÁNDEZ-LERMA, Mathematics Department, CINVESTAV-IPN, A. Postal 14-740, Mexico, D.F. 07000, Mexico

[Friday August 14 / vendredi le 14 août, 14:30 – FSC 1221]

Stochastic Control Systems with Long-Run Average Criteria

Stochastic control problems with long–run average criteria (also known as *ergodic criteria*) were introduced by Richard Bellman (1957) in the context of a manufacturing process, and nowadays play a predominant role in control applications to queueing systems, telecommunication networks, and economic and financial problems, to name a few.

This talk presents some recent advances on *discrete* and *continuous* time stochastic control systems with long–run average criteria, including overtaking (or catching–up) optimality, bias optimality, discount–sensitive criteria, and the existence of average optimal strategies with minimum variance.

ALEXANDER HOLROYD, UBC and Microsoft

[Friday August 14 / vendredi le 14 août, 14:00 – FSC 1221]

Finitary Colouring

Suppose that the vertices of Z^d are assigned random colours via a finitary factor of i.i.d. random vertex-labels. That is, the colour of vertex v is determined by a rule which examines the labels within a finite (but random and perhaps unbounded) distance R of v, and the same rule applies at all vertices. We investigate the tail behaviour of R if the coloring is required to be proper (that is, adjacent vertices receive different colours). Depending on the dimension and the number of colours, the optimal tail is either power law or super-exponential.

ROBERT MASSON, UBC, 1984 Mathematics Road, Vancouver, BC, V6T 1Z2

[Friday August 14 / vendredi le 14 août, 10:00 – FSC 1221]

Second moment estimates for the growth exponent of planar loop-erased random walk

The loop-erased random walk $\widehat{S}^n$ is the process obtained by running a random walk in Z^d from the origin to the first exit time of the ball of radius n and then chronologically erasing its loops. If we let M_n denote the number of steps of $\widehat{S}^n$ then the growth exponent α is defined to be such that $E[M_n]$ grows like n^α. The value of α depends on the dimension d. In this talk we'll focus on $d = 2$ where it's been shown that $\alpha = 5/4$. We will establish a second moment result and use it to get estimates for the probability that M_n is close to its mean. Namely, we show that there exists $0 < p < 1$ such that for all n and λ large, $P(M_n < \lambda^{-1} E[M_n]) < p^{\lambda^{1/6}}$.

This is joint work with Martin Barlow.

Probability
Probabilité

JEREMY QUASTEL, University of Toronto
[Saturday August 15 / samedi le 15 août, 9:30 – FSC 1221]
Scaling exponent of KPZ

We obtain bounds at the expected order for the variance of the logarithm of the solution of the stochastic heat equation and correlation functions of its derivative, which are understood as the solutions of the Kardar–Parisi–Zhang and Stochastic Burgers equations.

Joint work with Marton Balazs and Timo Seppalainen.

DENIZ SEZER, University of Calgary, University of Calgary, 2500 University Drive NW, Calgary, Alberta, T2N 1N4, Canada
[Thursday August 13 / jeudi le 13 août, 11:30 – FSC 1221]
Conditioning Super-Brownian Motion on its boundary statistics and a class of "weakly" extreme X-harmonic functions

Let X be a super-Brownian motion (SBM) defined on $\mathbb{R}^n$ and (X_D) be its exit measures indexed by sub-domains of $\mathbb{R}^d$. We pick a bounded sub-domain D, and condition the super-brownian motion inside this domain on its "boundary statistics", random variables defined on an auxiliary probability space generated by sampling from the exit measure X_D. Among these, two particular examples are conditioning on a Poisson random measure with intensity βX_D, and X_D itself. We find the conditional laws as h-transforms of the original SBM law using X-harmonic functions.

The X-harmonic function H^ν corresponding to conditioning on $X_D = \nu$ is of special interest, as it can be thought as the analogue of the Poisson kernel. An open problem is to show that H^ν is extreme at least for some ν when D is a smooth domain. An equivalent problem is to show that the tail sigma field of SBM in D is trivial with respect to P^ν. We prove a weaker version of this result using an approximation, first by conditioning on a Poisson random measure with intensity nX_D and then letting n go to infinity. We show that for any A in the tail sigma field of X, $P^{X_D}(A) = 0$ or 1 almost surely.

CHRISTINE SOTEROS, University of Saskatchewan, 106 Wiggins Road, Saskatoon, SK, S7N 5E6
[Friday August 14 / vendredi le 14 août, 9:30 – FSC 1221]
Knotting Probability for Stretched Polygons in a Lattice Tube

The topological entanglements of polygons confined to a lattice tube and under the influence of an external tensile force f will be examined. The tube constraint allows us to prove a pattern theorem via transfer matrix arguments for any arbitrary fixed value of f. The resulting stretched polygon pattern theorem can then be used to show that the knotting probability of an n-edge stretched polygon confined to a tube goes to one exponentially as $n \to \infty$. Thus as $n \to \infty$ when polygons are influenced by a force f, no matter its strength or direction, topological entanglements, as defined by knotting, occur with high probability.

This is joint work with M. Atapour and S. G. Whittington.

JOHN WALSH, UBC
[Thursday August 13 / jeudi le 13 août, 12:00 – FSC 1221]
The Roughness and Smoothness of Numerical Solutions to the Stochastic Heat Equation

The stochastic heat equation is the heat equation driven by white noise. We consider its numerical solutions using the finite difference method. Its true solutions are Hölder continuous with parameter $(\frac{1}{2} - \epsilon)$ in the space variable, and $(\frac{1}{4} - \epsilon)$ in the time variable. We show that the numerical solutions share this property in the sense that they have non-trivial limiting quadratic variation in x and quartic variation in t. These variations are discontinuous functionals on the space of continuous functions, so it is not automatic that the limiting values exist, and not surprising that they depend on the exact numerical schemes that are used; it requires a very careful choice of scheme to get the correct limiting values. In particular, part of the folklore of

the subject says that a numerical scheme with excessively long time-steps makes the solution much smoother. We make this precise by showing exactly how the length of the time-steps affects the quadratic and quartic variations.

This is joint work with Yuxiang Chong.

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Org: Jose Luis Cisneros-Molina (UNAM), **Ian Hambleton** (McMaster) and/et **Miguel Xicotencatl** (CINVESTAV)

Schedule/Horaire **Room/Salle: FSC-1222**

Thursday August 13 — jeudi 13 août

11:00 - 11:25	Alejandro Adem, *Commuting Elements and Simplicial Spaces of Homomorphisms*
11:30 - 11:55	Liviu Mare, *Equivariant cohomology of flag manifolds*
12:00 - 12:25	Jesus Gonzalez, *Symmetric topological complexity of projective spaces*
14:00 - 14:25	Olivier Collin, *Applications of instanton Floer homology to knots*
14:30 - 14:55	Eduardo Martinez-Pedroza, *Immersion of Surfaces in 2-Dimensional Complexes*
15:00 - 15:25	Daniel Juan Pineda, *Algebraic K-theory of virtually free groups*

Friday August 14 — vendredi 14 août

9:00 - 9:25	Ryan Budney, *Smooth embeddings of 3-manifolds in the 4-sphere*
9:30 - 9:55	Ernesto Lupercio, *Non-compact Frobenius Algebras*
10:00 - 10:25	Rick Jardine, *Pointed torsors and Galois groups*
13:30 - 13:55	Dale Rolfsen, *the space of orderings of a group*
14:00 - 14:25	Mario Eudave, *The Hexatangle II*
14:30 - 14:55	Peter Zvengrowski, *Span de Variedades de Stiefel Proyectivas / Span of Projective Stiefel Manifolds*

Saturday August 15 — samedi 15 août

9:00 - 9:25	Francisco J. Gonzalez-Acuña, *Higher dimensional manifolds with S^1-category two*
9:30 - 9:55	Donald Stanley, *A simply connected counter-example to Ganea's Conjecture of Smallest Dimension*
10:00 - 10:25	Andy Nicas, *The horofunction boundary of the Heisenberg group*
13:30 - 13:55	Sam Gitler, *Moment angle complexes*
14:00 - 14:25	Jim Bryan, *The Donaldson–Thomas and Gromov–Witten theory of orbifolds and their resolutions*

Abstracts/Résumés

ALEJANDRO ADEM, University of British Columbia
[Thursday August 13 / jeudi le 13 août, 11:00 – FSC-1222]
Commuting Elements and Simplicial Spaces of Homomorphisms

Using spaces of homomorphisms and the descending central series of the free groups, simplicial spaces are constructed for each integer $q > 1$ and every topological group G, with realizations $B(q, G)$ that filter the classifying space BG. In particular for $q = 2$ this yields a single space $B(2, G)$ assembled from all the n-tuples of commuting elements in G. Related stable splittings for spaces of commuting elements in a compact Lie group will also be discussed.

JIM BRYAN, Department of Math, UBC
[Saturday August 15 / samedi le 15 août, 14:00 – FSC-1222]
The Donaldson–Thomas and Gromov–Witten theory of orbifolds and their resolutions

There are two primary theories of "curve counting" on a Calabi–Yau threefold, Donaldson–Thomas theory and Gromov–Witten theory. Both theories extend to Calabi–Yau orbifolds. A three dimensional Calabi–Yau orbifold X has a canonical Calabi–Yau

resolution Y. The four curve counting theories $DT(X)$, $DT(Y)$, $GW(X)$, and $GW(Y)$ are expected to be equivalent. We give an overview of these theories and conjectural equivalences.

RYAN BUDNEY, Mathematics and Statistics, University of Victoria, PO Box 3045, STN CSC, Victoria, BC, V8W 3P4
[Friday August 14 / vendredi le 14 août, 9:00 – FSC-1222]
Smooth embeddings of 3-manifolds in the 4-sphere

An old theorem of C. T. C. Wall's states that every 3-manifold admits a smooth embedding in the 5-sphere. So if M is a closed 3-manifold different from the 3-sphere, the lowest-dimensional sphere that it embeds in is either 4 or 5. This talk will explore what is known about which closed 3-manifolds admit smooth embeddings into the 4-sphere.

OLIVIER COLLIN, Université du Québec à Montréal
[Thursday August 13 / jeudi le 13 août, 14:00 – FSC-1222]
Applications of instanton Floer homology to knots

In the last decade, 3-manifold topology has seen the first major applications of the ideas developed 20 years ago by the late Andreas Floer, most notably through the use of the Heegaard–Floer homology defined by Ozsváth and Szabó. Through recent work of Kronheimer and Mrowka, many of these advances can be recovered through a version of instanton Floer homology. In this talk we aim to look at some consequences for $\mathrm{SU}(2)$-representation varieties of knots in S^3. In particular we shall explain how $\mathrm{SU}(2)$-representation varieties of 2-fold branched covers detect the unknot and give a simple proof of a classical result of Scharlemann which asserts that unknotting number 1 knots are prime.

MARIO EUDAVE, Instituto de Matematicas, UNAM, Circuito Exterior, Ciudad Universitaria, 04510 Mexico DF, MEXICO
[Friday August 14 / vendredi le 14 août, 14:00 – FSC-1222]
The Hexatangle II

A tangle is a pair (B, A), where B is the 3-sphere with the interiors of a finite number of 3-balls removed, and A is a disjoint union of properly embedded arcs in B such that A meets each component of ∂B in four points. The Hexatangle is a certain tangle having six boundary components and a projection into the plane with no crossings. By filling the boundary components of a tangle with rational tangles we get knots and links in the 3-sphere. In a previous work we determined all the integral fillings on the hexatangle that produce the trivial knot. Now we consider arbitrary rational fillings of the hexatangle, and have a conjecture which says exactly when we can get the trivial knot. We show some partial results about this conjecture. The double branched cover of the hexatangle is a certain hyperbolic link L of six components in S^3. Our problem is equivalent to determining all Dehn surgeries on L that produce the 3-sphere. This link is interesting, for infinitely many hyperbolic knots which have exceptional surgeries are obtained by performing surgery on 5 components of L, and then a solution of the conjecture will lead to a listing of all such knots that are obtained from L.

This is joint work with Lorena Armas-Sanabria.

SAM GITLER, Cinvestav, Mexico
[Saturday August 15 / samedi le 15 août, 13:30 – FSC-1222]
Moment angle complexes

I will speak on new developments in moment angle complexes and toric topology.

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JESUS GONZALEZ, CINVESTAV
[Thursday August 13 / jeudi le 13 août, 12:00 – FSC-1222]
Symmetric topological complexity of projective spaces

Topological complexity was introduced by M. Farber as a way to measure intrinsic hardness in motion planning algorithms. It has been shown that this invariant captures the immersion dimension of projective spaces. I will describe the corresponding relationship between symmetric topological complexity and embedding dimension.

This is joint work with Peter Landweber.

FRANCISCO J. GONZALEZ-ACUÑA, Universidad Nacional Autónoma de México, Instituto de Matemáticas, Circuito Exterior, Ciudad Universitaria, 04510 México D.F.
[Saturday August 15 / samedi le 15 août, 9:00 – FSC-1222]
Higher dimensional manifolds with S^1-category two

A subset U of a closed topological n-manifold M is S^1-contractible (in M) if there exist maps $f\colon U \longrightarrow S^1$, $\alpha\colon S^1 \longrightarrow M$ such that the inclusion of U into M is homotopic to αf.

M has S^1-category $\leq k$ if it can be covered by k open subsets which are S^1-contractible.

Previously we have determined, for $n \leq 3$, the n-manifolds with S^1-category 2.

Theorem 1 *If $n > 3$ and M^n has S^1-category 2 then M^n is an n-sphere or an S^{n-1}-bundle over S^1.*

With J. C. Gómez-Larrañaga and W. Heil.

RICK JARDINE, University of Western Ontario, Dept. of Mathematics, London, ON, N6A 5B7
[Friday August 14 / vendredi le 14 août, 10:00 – FSC-1222]
Pointed torsors and Galois groups

Suppose that H is an algebraic group which is defined over a field k, and let L be the algebraic closure of k. The canonical stalk for the etale topology on k induces a simplicial set map from the classifying space $B(H\text{-tors})$ of the groupoid of H-torsors (a.k.a. principal H-bundles) to the space $BH(L)$. The homotopy fibres of this map are groupoids of pointed torsors, suitably defined. These fibres can be analyzed with cocycle techniques: their path components are representations of the absolute Galois groupoid in H, and each path component is contractible. The arguments for these results are simple, and applications will be displayed.

ERNESTO LUPERCIO, Cinvestav
[Friday August 14 / vendredi le 14 août, 9:30 – FSC-1222]
Non-compact Frobenius Algebras

In this talk I will report on my joint work with Ana Gonzalez and Carlos Segovia on the study of a generalization of Frobenius Algebras motivated by String Topology.

I will explain of the relation of such algebras with topological field theories, and to orbifolds.

LIVIU MARE, University of Regina, Regina, SK, S4S 0A2, Canada
[Thursday August 13 / jeudi le 13 août, 11:30 – FSC-1222]
Equivariant cohomology of flag manifolds

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The complex flag manifold $\mathrm{Fl}_n(\mathbb{C})$ is the space of all nested sequences

$$V_1 \subset \cdots \subset V_n,$$

where each V_k is a vector subspace of $\mathbb{C}^n$, $\dim V_k = k$. The group T of all diagonal unitary $n \times n$ matrices acts canonically on this space. The corresponding equivariant cohomology ring $H_T^*\big(\mathrm{Fl}_n(\mathbb{C})\big)$ admits two presentations: of Borel type (in terms of generators and relations) and of Goresky–Kottwitz–MacPherson type (in terms of restrictions to the fixed points of the action). In this talk I will present similar descriptions of the equivariant cohomology rings of the quaternionic and the octonionic flag manifolds relative to some appropriate group actions. The equivariant (topological, complex) K-theory of these spaces will also be discussed briefly.

EDUARDO MARTINEZ-PEDROZA, McMaster University
[Thursday August 13 / jeudi le 13 août, 14:30 – FSC-1222]
Immersion of Surfaces in 2-Dimensional Complexes

An outstanding conjecture by M. Gromov asserts that a one-ended hyperbolic group contains a subgroup isomorphic to the fundamental group of a closed surface. Motivated by this conjecture, we study the existence of immersions of closed surfaces in 2-dimensional CW-complex. Our results provide sufficient conditions for the existence of such immersions and imply the existence of surface subgroups in a particular class of hyperbolic groups.

Joint work with M. Forester and N. Brady.

ANDY NICAS, McMaster University
[Saturday August 15 / samedi le 15 août, 10:00 – FSC-1222]
The horofunction boundary of the Heisenberg group

We find the horofunction boundary of the $(2n+1)$-dimensional Heisenberg group with the Koranyi metric and show that it is homeomorphic to a $2n$-dimensional disk. We also show that the Busemann points correspond to the $(2n-1)$-sphere boundary of this disk and that the compactified Heisenberg group is homeomorphic to a $(2n+1)$-dimensional sphere. As an application, we find all isometries of the Koranyi metric.

This is joint work with Tom Klein.

DANIEL JUAN PINEDA, UNAM–Morelia
[Thursday August 13 / jeudi le 13 août, 15:00 – FSC-1222]
Algebraic K-theory of virtually free groups

We will indicate how to compute the algebraic K-theory groups of virtually free groups using the following facts:

(1) these are hyperbolic groups;

(2) they satisfy the Farrell–Jones Conjecture for K-theory.

DALE ROLFSEN, University of British Columbia, Vancouver
[Friday August 14 / vendredi le 14 août, 13:30 – FSC-1222]
the space of orderings of a group

A group is left-orderable if there is a strict total ordering $<$ of its elements so that $y < z$ implies $xy < xz$. If a group G is left-orderable, the set $\mathrm{LO}(G)$ of all left orderings has a natural topology, introduced by Sikora. I will outline the current state-of-the-art in understanding the space of orderings, and some of the applications of this theory.

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DONALD STANLEY, University of Regina, Regina, Saskatchewan, Canada
[Saturday August 15 / samedi le 15 août, 9:30 – FSC-1222]
A simply connected counter-example to Ganea's Conjecture of Smallest Dimension

For a topological space X, $\mathrm{cat}(X)$ is one less than the least number of open sets in X that it takes to cover X. Ganea conjectured that for any X, $\mathrm{cat}(X \times S^n) = \mathrm{cat}(X) + 1$. In 1997 Iwase constructed a series of counterexamples using the instability of certain Hopf invariants. The least dimension of the counterexamples was ten. On the other hand results of Vandembrouq imply that no simply connected counterexamples exist with dimension less that or equal to five. We construct a counter-example of dimension seven. Instead of unstable Hopf invariants, the example comes from a Hopf invariant stably factoring through another map. We will also discuss the remaining question of counterexamples of dimension six.

This is joint work with Hugo Rodriguez.

PETER ZVENGROWSKI, Department of Mathematics and Statistics, University of Calgary, Calgary, AB, T2N 1N4
[Friday August 14 / vendredi le 14 août, 14:30 – FSC-1222]
Span de Variedades de Stiefel Proyectivas / Span of Projective Stiefel Manifolds

En esta conferencia se hace un extracto de algunos de los resultados conocidos del span de las variedades de Stiefel proyectivas reales $X_{n,r}$; también se presentan algunos avances recientes obtenidos por P. Sankaran, J. Korbaš y el autor.

En el estudio de éste, se han aplicado numerosas técnicas, entre otras, fibrados vectoriales, clases características, operaciones cohomológicas primarias y secundarias, $K/$-teoría, álgebras de Cayley–Dickson, bordismo normal, etc., conduciendo a resultados fuertes e incluso, en muchos casos, a resulados exactos. El caso $X_{n,2}$, con n impar, parece ser el más difícil y a éste se le prestará especial atención en esta charla.

In this talk some of the known results on the span of the real projective Stiefel manifolds $X_{n,r}$ will be summarized, and some recent improvements due to work of P. Sankaran, J. Korbaš, and the author will be presented. A wide variety of techniques have been applied to this problem, including vector bundles, characteristic classes, primary and secondary cohomology operations, K-theory, Cayley–Dickson algebras, normal bordism, etc, leading to sharp and even exact results in many cases. The case $X_{n,2}$ with n odd seems to be the most difficult, and will receive special attention in the talk.