Women in Mathematics
Femmes en mathématiques
(Org: **Maritza Branker** (Niagara), **Barbara Keyfitz** (Fields Institute) and/et **Marie-Françoise Roy** (Rennes))

IVANA ALEXANDROVA, East Carolina University, Greenville, NC 27858, USA
Semi-Classical Resolvent Estimates at the Maximum of the Potential

We prove upper and lower bounds on the resolvent of the Schrodinger operator at an energy, which is the global non-degenerate maximum of the potential. Our upper bound improves the earlier bound of Nakamura '91 and our lower bound shows that our upper bound is near sharp. We next discuss an application of our upper resolvent estimate to proving an asymptotic expansion of the total scattering cross-section.

AMAL AMLEH, Saint Mary's University, 923 Robie Street, Halifax, NS B3H 3C3
Very Interesting Nonlinear Difference Equations: An Overview

In this talk I will introduce several classes of nonlinear difference equations which possess certain properties. In particular, I will present nonlinear difference equations in which:

- periodicity destroys boundedness,
- they possess a trichotomy character,
- local asymptotic stability does not imply global attractivity,
- every solution is periodic, eventually periodic, or converges to a periodic solution.

Recent and new results on rational difference equations together with several open problems and conjectures will be given.

MICHELE ARTIGUE, Université Paris–Diderot, Paris 7
Digital technologies in mathematics education: reflecting on a personal experience

In the last twenty years, I have been involved in research on the design and use of digital technologies in mathematics education, at different levels of schooling from middle school to university. My research has considered different technologies from dynamic geometry software, computer algebra systems and spreadsheets to on-line resources and diagnostic tools. In this lecture, I propose to use this personal experience as a clue for reflecting on the evolution of didactic research in that area, for showing the potential and limits of what has been achieved, and analysing up to what point the knowledge that has been accumulated makes us better able to put technological advances at the service of the improvement of mathematics education.

CHRISTINE BERNARDI, CNRS-Paris

LAURENCE BROZE, Université de Lille, BP 60149, F-59653 Villeneuve d'Ascq, France
La situation des mathématiciennes en France

Après 20 ans d'existence, l'association *femmes et mathématiques* a dressé un bilan de la situation des femmes au sein de la communauté mathématique.

S'il apparaît clairement que le nombre de jeunes filles étudiant les mathématiques a moins baissé que celui des garçons, elles restent peu nombreuses et sont surtout présentes dans l'enseignement secondaire où elles constituent un peu moins de la moitié (45%) des professeurs. Les femmes sont peu nombreuses à obtenir un doctorat (une centaine par an, soit environ un quart des effectifs) et à se lancer dans les métiers de l'enseignement supérieur et de la recherche.

Globalement, la présence des femmes travaillant dans l'enseignement supérieur et la recherche a progressé ces dernières années en France, passant, toutes disciplines confondues, de 29,7% en 1998 à 33% en 2005. La progression s'est surtout produite en sciences humaines (de 42,8% à 47,5%) et en sciences sociales (de 30,2% à 36,1%). Dans le secteur scientifique, c'est en chimie que la progression a été la plus forte (de 27,1% à 31,3%). En mathématiques, la situation des femmes s'est légèrement dégradée : la part de femmes a baissé, passant de 20,8% en 1998 à 20,4% en 2005. C'est surtout en mathématiques pures que la situation s'est dégradée. En particulier, la part des femmes ayant un poste de chercheuse à temps plein au CNRS ne fait que décroître.

ZOE CHATZIDAKIS, CNRS, Université Paris 7, UFR de Mathématiques, 75205 Paris cedex 13, France
Model theory of difference fields / Théorie des modèles des corps aux différences

Model theory is a branch of logic which studies algebraic structures from a logical point of view. I will present some of the now classical results of the model theory of difference fields (fields with a distinguished automorphism), and how they can be applied to solve problems in other areas of mathematics.

La théorie des modèles est une branche des mathématiques qui étudie des structures algébriques d'un point de vue logique. Je présenterai les résultats classiques de théorie des modèles de corps aux différences (corps avec un automorphisme distingué), et comment on peut parfois les utiliser pour résoudre des problèmes venant d'autres branches des mathématiques.

SARA FARIDI, Dalhousie University, Halifax, NS, Canada B3J 3J5
On conjugacy classes of nilpotent matrices

The focus of this talk is on ideals associated to conjugacy classes of nilpotent matrices. These ideals are indexed by partitions of the size of the matrix. In this talk we review these constructions, and study generating sets and properties of these ideals based on the Young diagrams of the partitions. We use our techniques to produce a counterexample to a related conjecture of Weyman.

This is joint work with Riccardo Biagioli and Mercedes Rosas.

VALERIE GIRARDIN, Laboratoire de Mathématiques N. Oresme, BP5186, Université de Caen, 14032 Caen Cedex, France
Entropy and Markov processes: from Shannon to the latest developments / Entropie et processus markoviens : de Shannon aux développements les plus récents

The concept of entropy is the basis of information theory. It has been introduced in the field of probability first by Boltzman in statistical mechanics and then by Shannon for studying communication systems.

Among a given family, the element with maximum entropy is the most informative one, the one that could happen in the greatest number of ways.

Entropy and Markov processes are linked since the first version of the asymptotic equipartition property stated by Shannon in 1948 for ergodic finite Markov chains. Many extensions have been proven since, especially for continuous time Markov processes and semi-Markov processes.

Le concept d'entropie est à la base de la théorie de l'information. Il a été introduit dans le domaine des probabilités par Boltzman en mécanique statistique, puis par Shannon pour l'étude de systèmes de communication.

Dans une famille donnée, l'élément maximisant l'entropie est le plus informatif, celui qui peut être réalisé du plus grand nombre de manières possibles.

L'entropie et les processus markoviens sont liés depuis la première version de la propriété d'équirépartition asymptotique énoncée par Shannon en 1948 pour des chaînes de Markov ergodiques finies. Depuis, de nombreuses extensions ont été prouvées, notamment pour les processus de Markov à temps continu ou pour les processus semi-markoviens.

PENNY HAXELL, University of Waterloo
List colouring

List colouring is a natural generalisation of the classical notion of colouring. A colouring of a graph G is an assignment of a colour to each vertex, such that no two vertices that are joined by an edge have the same colour. Normally one is interested in the chromatic number of G, which is the smallest possible number k of colours such that G has a colouring using k colours. In list colouring, we consider G together with a set of lists of permissible colours, one list for each vertex, and look for a colouring of G such that each vertex gets a colour from its list. The list chromatic number of G is the smallest k such that for every set of lists of length at least k given to the vertices, there exists a colouring of G from the lists. It is easy to see that the list chromatic number of any graph G is at least its chromatic number. However these two parameters can take very different values for some graphs. We discuss the list chromatic number of graphs and other more general structures.

YAEL KARSHON, University of Toronto
Convexity phenomena in Hamiltonian geometry

A moment map for a Hamiltonian torus action has three important properties:

- its image is convex;
- its level sets are connected;
- as a map to its image, it is an open map.

We will explain these phenomena by a purely topological "Local-Global Prinzip".

The only pre-requisite is a bit of point set topology.

BARBARA LEE KEYFITZ, Fields Institute and University of Houston
Women Mathematicians in the Academic Ranks: The BIRS Report

In the fall of 2006, a group of mathematicians and administrators met at BIRS to discuss the status of women mathematicians in academic positions in North America. At the conclusion of the meeting, it was decided to write a report, a 'Call to Action', addressed to our colleagues in mathematical sciences departments, in academic administration, at funding agencies, and at mathematics research institutes. Drawing on many studies and the collective experience of the group, the report formulated strategies for increasing the number of women faculty in mathematics departments. In this talk, I will give an overview of the situation, as seen by the workshop participants, and point to some significant recommendations.

RACHEL KUSKE, UBC
Transients + instabilities + noise = structure?

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 the transients can dominate the long range behavior. Coherence resonance is one relatively simple example of this transformation, and we consider others such as noise-driven synchronization in networks, disease dynamics in vaccinated populations, and amplitude-driven phase dynamics. The questions that arise in these contexts illustrate the influence of multiple time scales, cooperation of both discrete and continuous aspects in the dynamics, and the remnants of underlying bifurcation structure visible through the noise.

FAHIMA NEKKA, Université de Montréal, Faculté de Pharmacie and Centre de Recherches Mathématiques
The Explanatory Power of Drug Intake Variability in Therapeutic Evaluation

Recognition by the medical community and pharmaceutical industry of compliance as a major factor for therapeutic failure and economic cost led to a regain of interest from the scientific community. This interest has further been promoted by the availability of new techniques of compliance measurement for the acquisition of good quality data. Analysis of fine individual drug intake data, generally collected by electronic monitoring devices, has revealed that individual marked random patterns are likely to persist through long therapeutic periods. Recently, our group and others have been able to address the compliance problem in a more systematic and quantitative way, using advanced mathematical and statistical methods. In this talk, we will show how the necessary information representing the patient drug intake history can be extracted and then used to provide a fair evaluation of the pharmacological performance. We revisited several classical pharmacological principles in the stochastic context of patient's drug intake irregularity. To illustrate our procedure, we have considered two cases of HIV treatment using Kaletra® for once daily and twice daily regimens. We have quantified the impact on therapeutic effect of various characteristics in dosing regimens, namely missing doses and deviations from nominal times. Using our newly defined pharmacological indices, we clearly showed the ability of our probabilistic approach in measuring the impact of noncompliance. As direct fallout, we have discussed strategies to attenuate the impact of noncompliance through an optimal design of dosing regimen.

This work is in collaboration with Jun Li.

PANEL DISCUSSION,

MARYAM VERDIAN RIZI, SFU, Burnaby, BC, Canada
Triangulating the Torus with Two Odd Vertices: Structure and Coloring

We verify a conjecture of Grunbaum for a family of graphs on the torus: every bridgeless toroidal cubic graph with at most two odd faces is 3-edge colorable. As a key step we classify the set of triangulations of the torus having minimum degree five and exactly two odd-degree vertices. Our techniques involve some invariants and special walks, also some topology.