

OBERWOLFACH-SEMINARS 2002

These seminars are a continuation of the DMV-Seminars initiated by **Deutsche Mathematiker Vereinigung**. They address postdocs and Ph.D. students from all over Europe. The aim is to introduce the participants to a particular hot development. The seminars take place at Mathematisches Forschungsinstitut Oberwolfach. The number of participants is restricted to 25. Applications including a short summary of previous work and interest should be sent to

Prof. Dr. Gert-Martin Greuel
Universität Kaiserslautern, Fachbereich Mathematik
Erwin-Schrödinger-Str. / 67663 Kaiserslautern / Germany

Finite Markov Chains

Jim Fill (The John Hopkins University), Laurent Saloff-Coste (Cornell University)

May 19 - 25, 2002, Deadline for Application: April 15, 2002

Subjects: The aim of these lectures is to present some modern aspects of the theory of finite ergodic Markov chains. One focus will be on bounds on the time needed to reach approximate equilibrium; another will be on perfect simulation. Techniques to be presented include both (1) analytic methods based on eigenvalues, functional inequalities, and comparison, and (2) probabilistic methods such as coupling, strong stationary times and duality, coupling from the past, and the Randomness Recycler.

Prerequisites are familiarity with basic functional analysis and probability theory.

Ginzburg-Landau Functionals

Tristan Riviere (ETH Zürich), Etienne Sandier (Paris 12), Sylvia Serfaty (Courant Institut)

October 13 - 19, 2002, Deadline for Application: September 1, 2002

Subjects: The rigorous analysis of the formation, the nature and the location of vortices for solutions to the Ginzburg-Landau Equations arising in the physics of superconductors has grown extensively these last ten years. There are obvious physical motivations that have stimulated these works but the diversity of the analysis involved in understanding these phenomena is perhaps the reason for such a development. The study of the static or dynamic aspects of the Ginzburg-Landau Vortices goes from abelian gauge theory to fluid mechanics with the use of numerous advanced techniques from linear and non-linear PDE (variational and critical point methods, energy renormalizations, free boundary problems, Gamma convergences, mean curvature motions, tools from geometric measure theory etc). We will present basic properties of these techniques and explain how they adapt to the context of Ginzburg-Landau equations to explain various features of vortices in 2 and 3 dimensions.

Prerequisites: Basic functional analysis, measure theory, some familiarity with Partial Differential Equations (especially elliptic and parabolic problems).

Mass Transportation Problems and Applications

Luigi Ambrosio (SNS Pisa), Cedric Villani (ENS Lyon)

October 13 - 19, 2002, Deadline for Application: September 1, 2002

Subjects: Recent years have seen the emergence of new directions in the study of optimal mass transportation, with connections to fluid mechanics, linear and nonlinear diffusion processes, calculus of variations, functional inequalities with a geometrical content, particle systems. This school will deal both with the study of the mass-transportation problem and with its applications to these various fields.

Prerequisites: No advanced notions are required, only a good familiarity with elementary measure theory, basic functional analysis and basic theory of PDE's.

Explicit Algebraic Number Theory

Hendrik Lenstra (Berkeley & Leiden), Peter Stevenhagen (Leiden)

November 10 - 16, 2002, Deadline for Application: October 1, 2002

Subjects: The title 'Explicit algebraic number theory' is borrowed from the series of Oberwolfach meetings on 'Explicit methods in number theory'. Those meetings are characterized by a lively interaction between abstract and advanced arithmetic theories on the one hand and concrete and elementary questions on the other. The spirit of the present seminar is similar, within the smaller compass of algebraic number theory. The emphasis is on problems in the latter area inspired by questions from other areas of mathematics, including elementary and algorithmic number theory, arithmetic algebraic geometry, and computer algebra. The advanced techniques from algebraic number theory that apply to these problems include class field theory, infinite Galois theory, and the theory of quadratic forms. The purpose of the seminar is to impart a working knowledge of these theories to the participants, to provide ample illustrations of their use, and to formulate several open problems that may be approachable by means of the same techniques.

Prerequisites: Basic algebra, number theory, and point set topology, including Galois theory, algebraic number theory, and a knowledge of p-adic numbers.

Mathematical Relativity

Robert Bartnik (Canberra), Piotr T. Chrusciel (Tours)

November 10 - 16, 2002, Deadline for Application: October 1, 2002

Subjects: The Einstein equations govern the gravitational forces in spacetime and the propagation of gravitational energy. Standing at the cross-roads of differential geometry and partial differential equations, they present many challenging mathematical problems. These seminars will focus on two areas: the initial value problem and the constraint equations, and the measuring of the energy content of gravitational fields.

Prerequisites: Basic differential geometry, and analysis of partial differential equation.

Symplectic Geometry

Miguel Abreu (Lissabon), Leonid Polterovich (Tel Aviv), Matthias Schwarz (Leipzig)

November 17 - 24, 2002, Deadline for Application: October 1, 2002

Subjects: Symplectic geometry has undergone a rapid development in the past two decades by the use of the powerful methods of non-linear functional analysis and complex algebraic geometry. A tremendous progress has been achieved in a number of long-standing problems including classification of symplectic structures on four-manifolds and the seminal Arnold conjecture on periodic orbits of Hamiltonian systems. Powerful new symplectic invariants closely related to modern Mathematical Physics have been discovered. This course will provide an introduction to selected modern areas in symplectic geometry. An introduction to Gromov's theory of pseudo-holomorphic curves will be given together with the Morse-theoretical version known as Floer homology. Applications to the classification of symplectic four-manifolds, Hamiltonian dynamics and the geometry of the group of Hamiltonian diffeomorphisms will be discussed.

Prerequisites: Firm knowledge in analysis on manifolds, basic knowledge in differential geometry / algebraic topology