Summer School on Modern Dynamics

Titles and Abstracts

Alex Blumenthal

Title: Statistical properties of chaotic dynamical systems

Abstract:
Many dynamical systems exhibit chaotic or seemingly random asymptotic behavior, even when the dynamics is defined in a deterministic way. For smooth dynamical systems on a manifold, the infinitesimal mechanism (usually) responsible for chaotic behavior is hyperbolicity, i.e., stretching and contracting in various directions in tangent space. In this lecture series, I will give an overview of this mechanism from the statistical perspective, largely focusing on the problem of generalizing the Law of Large Numbers (classically, for averages of sums of IID random variables) to time-averages of observables of a chaotic dynamical system. Topics I intend to cover include: a rapid introduction to ergodic theory; basic theory of uniformly hyperbolic dynamical systems (e.g., Anosov or Axiom A systems); and a brief introduction to nonuniformly hyperbolic theory (also known as Pesin theory). Time permitting, I will discuss some specific examples in more depth in an effort to convey why nonuniform hyperbolicity is a rich and challenging subject.

Yitwah Cheung

Title: Dynamics of lattices and translation surfaces

Abstract: This lecture series will present the interplay between number theory and dynamics through concrete examples that illuminate basic ideas from ergodic theory, such as Poincare recurrence, generic points and unique ergodicity. The plan is to present a precise formulation of Dani correspondence, illustrate how well-known maps,
such as the Gauss continued fraction map, arise as a Poincare sections of various well-studied flows, motivate the study of translation flows, leading up to an elementary
proof of Masur's criterion for unique ergodicity.

Yuri Lima

Title: Symbolic dynamics for nonuniformly hyperbolic systems

Abstract: We describe the recent advances in the construction of Markov partitions for nonuniformly hyperbolic systems. One important feature of this development comes from a finer theory of nonuniformly hyperbolic systems, which we also describe. The class of systems includes diffeomorphisms, flows, and maps with singularities (both invertible and non-invertible). We also discuss some dynamical and statistical applications on the existence of the Markov partition, such as the problem of counting closed trajectories and properties of equilibrium states.

Filip Simion

Title: An introduction to dynamics on K3 surfaces

Abstract: The course will start with an introduction to K3 surfaces, with their geometric and algebraic properties. In particular, I will discuss the existence of Ricci flat metrics, as well as the Torelli theorems that allow one to characterize K3s using linear algebraic data. After establishing these background facts, I will explain some of their applications to the dynamics of K3 surface automorphisms. In particular, I will discuss examples of McMullen showing the existence of Siegel domains for certain automorphisms, as well as some measure rigidity results first established by Cantat & Dupont.

Zhiyuan Zhang

Title: Renormalisation of circle diffeomorphisms
Abstract:
We introduce the application of the renormalisation technique to the linearization problem of analytic circle diffeomorphisms.