8th Graduate Colloquium of the Swiss Doctoral Program in Mathematics

Mathematisches Institut Basel
Grosser Hörsaal

8 and 9 September, 2011

Thursday, 8 September

11:30–12:30 Gibbs measures of the 2d Ising model

Loren Coquille, University of Geneva

In the late 1970s, in two celebrated papers, Aizenman and Higuchi independently established that all infinite-volume Gibbs measures of the 2d Ising model are a convex combination of the two pure phases. After introducing the relevant definitions and concepts needed to understand the physical content of this result, I will present a new approach to it, with a number of advantages:

(i) a finite-volume, quantitative analogue (implying the classical claim) is obtained;
(ii) the scheme of the proof seems more natural and provides a better picture of the underlying physical phenomenon;
(iii) this new approach seems substantially more robust (possible extension to the Potts model).

This is a joint work with Yvan Velenik.

14:00–15:00 Hyperplane sections and degree matrices

Matey Mateev, University of Basel

If V is a subscheme of P^n and F is a general hypersurface of degree d, then F cuts out on V a subscheme $Z = V \cap F$, which is also a subscheme of F . A natural and interesting question is to study the properties that either Z or V transfers to the other. In this talk we will discuss this problem and will show how to construct a curve C in P^3 whose general hyperplane section $Z = C \cap L$ in P^2 has a given degree matrix.

15:20–16:20 Right-angles, hyperbolicity and dimension

Alexander Kolpakov, University of Fribourg

Right-angled polyhedra turn out to be an interesting family of (almost) hyperbolic polytopes. They are connected with other various problems and notions, e.g. right-angled Coxeter groups, Loebell manifolds, combinatorial volume estimates and decompositions of acute-angled polyhedra, dimension bounds. In my talk, a survey on the main part of this zoo will be given together with a brief explanation of what I'm doing.

16:40–17:40 Quasi-stationary distributions for stochastic approximation algorithms with constant step size

Bastien Marmet, University of Neuchatel

Friday, 9 September

9:30–10:30 On the topologies on ind-varieties

Immanuel Stampfli, University of Basel

In the 1960s Shafarevich introduced ind-varieties in order to explore some naturally occurring groups that allow the structure of an infinite-dimensional analogon of an algebraic group (such as the group of polynomial automorphisms of $\mathbb{C}^n$). Shafarevich defined an ind-variety as the successive limit of an increasing chain

$$X_1 \subseteq X_2 \subseteq X_3 \subseteq \dots$$

of varieties X_n, each one closed in the next. There are essentially two ways of endowing such an ind-variety with a topology. One topology is naturally induced by the increasing chain of varieties and is due to Shafarevich. The other is naturally induced by the regular functions on the ind-variety and is due to Kambayashi. These topologies differ on a rather large class of ind-varieties. The aim of this talk is to give an idea of the proof of this result.

11:00–12:00 Gordian distance, torus knots and three variants of adjacency

Peter Feller, University of Bern

We define classical knots and explain how they form a discrete metric space with respect to the Gordian distance. Then we give different descriptions of the subspace of torus knots. Finally we introduce three notions of adjacency for torus knots and conclude with some examples of Gordian adjacency and some of our questions.

13:30–14:30 Witt groups in linear algebraic groups

Iulian Ion Simion, EPFL

After a description of Witt groups I will show how they play a role in my current work namely in studying the centralizer of unipotent elements in linear algebraic groups for small characteristic. We will describe how one constructs such subgroups with examples both in the classical and exceptional cases.

14:50–15:50 Trace zero varieties in cryptography

Maike Massierer, University of Basel

Elliptic curves defined over finite fields are one of the most important types of groups used in cryptography today. Trace zero varieties arise from certain subgroups of such elliptic curves, namely those points of trace zero. They are interesting from a constructive point of view, because they allow fast arithmetic, and also from a cryptanalytic point of view, since the security of many cryptographic protocols is directly linked to the properties of these varieties. For both constructive and destructive use of trace zero varieties, it is important to be able to efficiently represent their elements. We discuss the geometric construction that leads to the trace zero variety, and how to find an easy and compact representation of trace zero elements.