Analysis and Probability

K. Astala *Liquid domains and dimer models; universality for geometry of frozen boundaries*

Abstract: In this talk, based on joint work with E. Duse, I. Prause and X. Zhong, we study the limiting geometry of random tilings and dimer models under scaling limits, and the boundaries between their ordered and disordered (or frozen and liquid) limit regions. We show, among other things, that within all dimer models, the geometry of frozen boundaries is universal, i.e. the same for all dimer models.

The liquid region carries a natural complex structure, which turns out can be described by a quasilinear Beltrami equation with very specific properties. Connecting this to a (very degenerate) free boundary problem then allows one to describe various aspects of the boundaries of the liquid domains and other related quantities.

O. Ivrii *Describing Blaschke products by their critical points*

Abstract: In this talk, I will discuss a question which originates in complex analysis but is really a problem in non-linear elliptic PDE. It is well known that up to post-composition with a Möbius transformation, a finite Blaschke product may be uniquely described by the set of its critical points. I will discuss an infinite degree version of this problem posed by Konstantin Dyakonov. Let $\mathscr{J}$ be the set of inner functions whose derivative lies in the Nevanlinna class. I will explain that an inner function in $\mathscr{J}$ is uniquely determined by the inner part of its derivative (its critical structure), and describe all possible critical structures of inner functions in $\mathscr{J}$. I will also give a concrete description of the natural topology on $\mathscr{J}$ which respects the convergence of critical structures.

N. Makarov *Calculus on Riemann surfaces*

Abstract: I will give 'physical' (and probabilistic) interpretations of various formulas in function theory (e.g. analogues of addition theorems). Joint work with Nam-Gyu Kang.

A. Okounkov *Bethe Ansatz from different perspectives*

Abstract:

Abstract: This will be an introductory talk about finding the spectrum of the transfer matrix in integrable lattice models. This very classical topic is frequently revisited with every new set of tools that mathematical physicists discover. Geometric ideas in exactly solvable models, pioneered by Nekrasov and Shatashvili, are no exception to this rule and we will see what they say about the Bethe eigenvectors.

A. Poltoratski *Toeplitz methods in spectral problems for canonical Hamiltonian systems*

Abstract: New methods based on the use of truncated Toeplitz operators brought recent progress in the area of gap and type problems of Fourier analysis. In my talk I will discuss how similar techniques can help solve inverse spectral problems for differential operators. The talk is based on joint work with Nikolai Makarov.

E. Saksman *On Multiplicative Chaos*

Abstract: We give an overview of Gaussian multiplicative chaos and explain how it appears as the limit statistics for several models in random matrix theory, statistical physics, and number theory. If time allows, we also describe some recent results on the multiplicative chaos theory. The talk is based on joint work with Janne Junnila (University of Helsinki), Miika Nikula (Aalto University), and Christian Webb (Aalto University).

M. Sodin *Nodal sets of random spherical harmonics*

Abstract: In the talk I will describe what is known and (mostly) unknown about asymptotic statistical topology of zero sets of random spherical harmonics of large degree on the two-dimensional sphere.

I will start with several provocative open questions and then will discuss a non-trivial lower bound for the variance of the number of connected components of the zero set recently obtained with Fedor Nazarov. Our argument can be viewed as, probably, the first (though very weak) rigorous support of the beautiful Bogomolny-Schmit heuristics, which connects the asymptotic nodal counting with a random loop ensemble generated by a percolation-like model on graphs with vertices having degree four.

X. Tolsa *Harmonic measure via blowups, monotonicity formulas, and Riesz transforms*

Abstract: In this talk I will review some recent recent results on harmonic measure in the n-dimensional space which involve real analysis techniques such as blowups, monotonicity formulas, and Riesz transforms. In particular, I will recall a recent proof of Tsirelson's theorem for triple points for harmonic measure (by Tolsa and Volberg), the solution of the two-phase problem (by Azzam, Mourgoglou, Tolsa and Volberg), and the characterization of the weak A_∞ condition for harmonic measure (by works of Hofmann - Martell; and Azzam - Mourgoglou - Tolsa). I plan to sketch some of the ideas involved in the proofs.

Y. Wang *The Loewner energy of a simple loop on the Riemann sphere*

Abstract: Loewner introduced in 1923 a way to encode a simple curve on the Riemann sphere by a real-valued driving function via iterations of

conformal distortions. This idea led to the birth of the Schramm-Loewner evolution (SLE), introduced by Oded Schramm, which describes successfully the interfaces in various critical statistical mechanics models during the last 20 years. The Loewner's energy is naturally related to SLEs as their large deviation rate function. The notion of Loewner loop energy was introduced in joint work with Steffen Rohde, where we show it to be a conformally invariant quantity on free loops which vanishes only on circles. In this talk, I will present my recent work on the intrinsic and equivalent descriptions of the Loewner energy via zeta-regularized determinants of Laplacians and show that it is also a Kähler potential of the Weil-Petersson metric in the universal Teichmüller space.