Rényi 100 conference
Budapest, Hungary, 20 June - 23 June 2022

Alon, Noga (Princeton & Tel Aviv)
Random processes of graphs and permutations
Plenary
Monday, 20 June, 10:30-11:30, Festive Hall

Abstract: The random graph process, introduced by Erdős and Rényi, stimulated a considerable amount of research focusing on the study of hitting time results for monotone graph properties. A variant of this process is the vertex random graph process that arises naturally when studying the smallest possible number of vertices of a graph which contains every graph on n vertices as an induced subgraph - a problem first studied by Moon in the 60s, which received a considerable amount of attention over the years. A similar random process exists for permutations and arises in the study of the smallest possible length of a permutation that contains every permutation of size n, as well as in the investigation of additional problems for random permutations.

I will discuss these random processes, starting with the one of Erdős and Rényi and focusing on several recent results and problems including a solution of Moon's problem and a detailed analysis, obtained jointly with Elboim and Sly, which settles a problem of Georgiou, Katkov and Tsodyks about the random permutation process.

Arikan, Erdal (Bilkent University, Ankara)
Guessing and Renyi Entropy
INFORMATION THEORY (CLASSICAL)
Monday, 20 June, 15:30-16:20, Small Lecture hall

Abstract: Consider a guessing game with two parties Alice and Bob. Alice picks a number X from a probability distribution on a finite set. Bob seeks to learn the number by asking Alice questions of the form "Is X equal to x?". Let G denote the number of questions Bob asks until he gets a YES answer from Alice. This type of guessing problem is a model for certain depth-first search decoding algorithms in channel coding. Rényi entropy of the random variable X happens to determine the asymptotic behavior of the moments of the guesswork random variable G. We discuss some known and some new results on this subject.

Barron, Andrew (Yale)
TBA
Plenary
Tuesday, 21 June, 10:30-11:20, Festive Hall

Berkes, István (Rényi Institute, Budapest)
From Rényi's stochastic geyser to dependent KMT approximation: a history of strong invariance principles

PROBABILITY AND STATISTICS
Thursday, 23 June, 15:30-16:20, Reading room

Abstract: Strong approximation theory in stochastics starts with Rényi's stochastic geyserproblem (1962) and Strassen's seminal papers (1964-65) on almost sure Wiener-approximation of partial sums of independent random variables and martingales. Using a different method, optimal approximation rates in the i.i.d. case were obtained by Komlós, Major and Tusnády (1975/76), providing a new, powerful tool for proving limit theorems in probability and statistics. Philipp and Stout (1975) extended the martingale approach to large classes of dependent sequences such as mixing sequences, Markov chains and Gaussian processes. Proving optimal results in the dependent case remained open for 40 years, until settled independently by Berkes, Liu and Wu (2014) and Merlevède and Rio (2015).

Gautami, Bhowmik (Université de Lille)
Consequences of the Goldbach problems
NUMBER THEORY
Monday, 20 June, 14:10-15:00, Reading room

Abstract: We will discuss conditional results around the Goldbach conjecture. In an asymptotic form of its generating function, the Goldbach problem is equivalent to the R(iemann) H(ypothesis). A good average order when the primes are in arithmetic progression is conjectured by Granville to be equivalent to the G(eneralised) RH and as yet only partially understood (B, Halupczok, Matsumoto, Ruzsa, Suzuki). Another example is the consequence of Goldbach problems on Landau-Siegel zeros which are possible counter-examples to the GRH. Assuming plausible conjectures like a weak Hardy-Littlewood one due to Fei and our still weaker form do improve the classical results on Siegel zero-free regions. Continuing on these lines, Friedlander-Goldston-Iwaniec-Suriajaya (2022) showed that the assumption of Fei's conjecture is enough to disprove the existence of Siegel zeros.

Bollobás, Béla (Memphis & Cambridge)
Large Sumsets from Small Subsets
Plenary
Tuesday, 21 June,11:30-12:20, Festive Hall

Abstract: In this talk I shall present some of the recent results obtained by Imre Leader, Marius Tiba and me. The aim of these results was to start the investigation of a new body of questions in additive combinatorics. An early example of a large family of results concerning the sum of subsets is the fundamental Cauchy–Davenport theorem, which gives us the optimal lower bound on the size of a sumset $A + B$ for subsets of the cyclic group p of prime order p. What happens if we restrict the number of elements of one set that we may use to form the sums? In the case of the Cauchy-Davenport theorem, given two subsets, A and B, does B have a subset B' of bounded size such that $A + B'$ is large, perhaps even close to the optimal lower bound?

Our main results show that, rather surprisingly, in many circumstances it is possible to use only boundedly many elements of B and still obtain the optimal bound on

$|A+B|$. In addition, we prove inverse results, 'unbalanced' variants, when the sizes of A and B differ, and results in the continuous setting. The applications of our results include considerable extensions of the Erdős-Heilbronn problem.

Browning, Timothy (IST Austria)
The large sieve and local solubility
NUMBER THEORY
Monday, 20 June, 15:30-16:20, Reading room

Abstract: Over 70 years ago, Rényi helped to develop the large sieve in order to show that any even integer can be represented as the sum of a prime and an almost prime. Since then, the large sieve has evolved into one of the most flexible tools in the analytic number theory toolbox. In this talk, I will discuss the role that it plays in the study of local solubility in families of algebraic varieties defined over the rational numbers.

Coja-Oghlan, Amin (Goethe-Universität Frankfurt)
The group testing problem
RANDOM GRAPHS AND NETWORKS 1.
Thursday, 23 June, 16:30-17:20, Large lecture hall

Abstract: In group testing the aim is to identify a small set of infected individuals within a large population size. To this end we have at our disposal a test procedure capable of testing groups of individuals, with the test returning a positive result iff at least one individual in the group is infected. In this talk we will see how random graphs lead to an optimal test design.

Dolgopyat, Dmitry (University of Maryland)
Exponential mixing implies Bernoulli
ERGODIC THEORY AND DYNAMICAL SYSTEMS
Thursday, 23 June, 15:30-16:20, Small Lecture Hall

Abstract: Exponential mixing is the strongest statistical property of smooth systems, while Bernoullicity, that is, being measure theoretically isomorphic to a Bernoulli shift is the strongest statistical property in the measure preserving category. In this talk I describe the proof of the fact that for systems preserving a smooth measure exponential mixing implies Bernoulli property. Based on a joint work with Adam Kanigowski and Federico Rodriguez Hertz.

Erdős, László (IST Austria)
Universality phenomena for random matrices
Plenary
Wednesday, 22 June, 11:30-12:20, Festive Hall

Abstract: Large random matrices tend to exhibit universal fluctuations. Beyond the well-known Wigner–Dyson and Tracy–Widom eigenvalue distributions, we overview

other universality results for Hermitian and non-Hermitian matrices. We focus on the emergence of normal distribution involving eigenvectors, especially on the random matrix version of quantum unique ergodicity.

Gantert, Nina (Technical University of Munich)
Mixing times for exclusion processes with open boundary
STOCHASTICS WITH INTERACTIONS
Tuesday, 21 June, 14:10-15:00, Small Lecture Hall

Abstract: present some recent results about (sequences of) exclusion processes with open boundaries on finite graphs, about their mixing times and about the cutoff phenomenon. In particular, we study mixing times of the symmetric and asymmetric simple exclusion process on the segment where particles are allowed to enter and exit at the endpoints. We consider different regimes depending on the entering and exiting rates as well as on the rates in the bulk, and show that the process exhibits pre-cutoff and in some cases cutoff. Based on joint work with Evita Nestoridi and Dominik Schmid.

Gouezel, Sebastien (Université de Nantes)
Ruelle Resonances for Geodesic Flows on Noncompact Manifolds
ERGODIC THEORY AND DYNAMICAL SYSTEMS
Thursday, 23 June, 16:30-17:20, Small Lecture Hall

Abstract: Ruelle resonances are complex numbers associated to a dynamical system that describe the precise asymptotics of the correlations for large times. It is well known that this notion makes sense for smooth uniformly hyperbolic dynamics on compact manifolds. In this talk, I will consider the case of the geodesic flow on some noncompact manifolds. In a class of such manifolds (called SPR), I will explain that one can define Ruelle resonances in a half-plane delimited by a critical exponent at infinity. Joint work with Barbara Schapira and Samuel Tapie.

Grimmet, Geoffrey (University of Cambridge)
Percolation thresholds
PROBABILITY AND STATISTICS
Thursday, 23 June, 14:10-15:00, Reading room

Abstract: In classical percolation theory, one studies the geometry of a random subset of a Euclidean graph (such as the square lattice). The key questions concern the existence and nature of percolation phase transitions. This lecture is an account of rigorous work from 1960 to 2022 on exact values of, and relations between, the values of critical points for percolation on planar graphs. The special role of isoradial graphs will be exposed. Certain predictions (from 1964) of Sykes and Essam concerning matching pairs of lattices can be extended to hyperbolic space (joint work with Zhongyang Li).

Hairer, Martin (Imperial College London)
The Brownian Castle and its crossover processes

Plenary
Thursday, 23 June, 9:00-9:50, Festive Hall

Abstract: Two natural Markov processes in $1+1$ dimension arising as scaling limits of discrete systems with local interactions are the stochastic heat equation (or EW model) and the recently described KPZ fixed point. Here, we study a third such process which we call the Brownian Castle (BC). We also describe a class of processes arising from the BC $\to$ EW crossover regime, showing in particular that the latter is non-universal, unlike the EW $\to$ KPZ crossover.

Heckel, Annika (Uppsala University)
The (non-)concentration of the chromatic number
RANDOM GRAPHS AND NETWORKS 2.
Tuesday, 21 June, 15:30-16:20, Large lecture hall
Abstract: How much does the chromatic number of the random graph $G(n, 1/2)$ vary? A classic result of Shamir and Spencer says that it is contained in some sequence of intervals of length about $n^{1/2}$. Until recently, no non-trivial lower bounds on the fluctuations of the chromatic number of a random graph were known, even though the question was raised by Bollobás many years ago. I will talk about the main ideas needed to prove that, at least for infinitely many n, the chromatic number of $G(n, 1/2)$ is not concentrated on fewer than $n^{1/2-o(1)}$ consecutive values.

I will also discuss the Zigzag Conjecture, made recently by Bollobás, Heckel, Morris, Panagiotou, Riordan and Smith - this proposes that the correct concentration interval length 'zigzags' between $n^{1/4+o(1)}$ and $n^{1/2+o(1)}$, depending on n - as well as various finer conjectures on the exact concentration interval length and limiting distribution.

Based on joint work with Oliver Riordan and with Konstantinos Panagiotou

Hochman, Mike (The Hebrew University)
From linear algebra to equidistribution
ENTROPY AND DIMENSION
Monday, 20 June, 15:30-16:20, Large lecture hall
Abstract: I will discuss how simple equidistribution results in the context of linear algebra give rise to equidistribution results related to fractal sets with linear symmetries.

Holevo, Alexander (Russian Academy of Sciences)
Quantum Gaussian maximizers and Log-Sobolev inequality
QUANTUM INFORMATION THEORY
Tuesday, 21 June, 14:10-15:00, Reading room

Abstract: We suggest a method of computation of the classical capacity of quantum measurement channel based on principles of convex programming. It is targeted to solve the problem of Gaussian Maximizers for models out of the scope of the "threshold condition" (which ensures that the upper bound for the capacity as a difference between the maximum and the minimum output entropies is attainable on Gaussian

ensembles). The method is illustrated by the case of unsharp position measurement with the quantum oscillator energy constraint, underlying noisy Gaussian homodyning in quantum optics. Rather remarkably, for this model the method reduces the solution of the optimization problem to a generalization of the celebrated log-Sobolev inequality. We hope that this method should work also for other models where the "threshold condition" is violated.

Kang, Mihyun (Technische Universität Graz)
Random subgraphs of the hypercube
RANDOM GRAPHS AND NETWORKS 2.
Tuesday, 21 June, 14:10-15:00, Large lecture hall

Abstract: We consider a random subgraph of the hypercube in the supercritical regime. We derive vertex expansion properties of the giant component. As a consequence we determine the diameter of the giant component and the mixing time of the lazy random walk on the giant component. This talk is based on joint work with Joshua Erde and Michael Krivelevich.

Körner, János (La Sapienza Roma)
The hidden side of Information Theory
INFORMATION THEORY (CLASSICAL)
Monday, 20 June, 14:10-15:00, Small Lecture Hall

Abstract: Rényi had a profound philosophical interest in Information Theory. In his scientific papers ideas come and evolve before mathematical problems. He was the founder of a mathematical school in Information Theory in Hungary. Long after his death, his students keep going back to his thoughts and results. One of his last publications, the posthumous book Foundations of probability, has been motivating my own research in an around information theory in the last 30 years.

I will explain this inspiration and survey the results.

Lutz, Warnke (UC San Diego)
The phase transition in the random d-process
RANDOM GRAPHS AND NETWORKS 2.
Tuesday, 21 June, 16:30-17:20, Large lecture hall

Abstract: In a groundbreaking paper from 1960, Paul Erdős and Alfréd Rényi established the foundations of random graph theory. In particular, they discovered the 'phase transition' that random graphs undergo as they acquire more and more edges, i.e., the sudden change of the component structure from only small components to a single 'giant' component plus small ones. Furthermore, they also suggested the study of more complex random graphs, including models whose time evolution depends on the vertex-degrees.

In this talk we shall discuss the phase transition in one of the most natural random graph models that fits the suggestion of Erdős and Rényi: in the random d-process we start with an empty graph on n vertices, and then step-by-step add new random edges so that the maximum degree always remains at most d (this model differs from the

usual configuration model). For fixed $d \geq 3$, we show that the d-process undergoes a phase transition, and determine the asymptotic size of the giant component. For $d = 2$ we show a different behavior, namely that the giant component has a non-trivial distribution at the end of the 2-process. These results solve a problem of Wormald from 1997, and verify a conjecture of Balinska and Quintas from 1990.

The proofs are based on an interplay between discrete and continuous methods, with connections to ideas and heuristics arising in percolation theory as well as aggregation and coagulation theory.

Based on joint work with Nick Wormald and Laura Eslava, respectively.

Michaleczky, György (ELTE Eötvös Loránd University)
Qualitative and quantitative (in)dependence
PROBABILITY AND STATISTICS
Thursday, 23 June, 16:30-17:20, Reading room

Abstract: The connection between the qualitative independence of σ-fields and the "probabilistic" independence of σ -fields already has a long history.

The basic idea is the following: Assume that we are given several σ-fields $\mathcal{F}_t$, $t \in T$ with *compatible* measures μ_t, $t \in T$, where μ_t is defined on $\mathcal{F}_t$, where compatibility means that $\mu_{t_1}(A) = \mu_{t_2}(A)$ if $A \in \mathcal{F}_{t_1} \cap \mathcal{F}_{t_2}$.

Construct a common extension of these measures to the σ-field generated by $\mathcal{F}_t, t \in T$! Or, construct a common extension under which the original σ-fields are independent of each other. Moreover, instead of independence we may require some conditional independence structure.

The history of this problem goes back to G. Fichtenholz and L. Kantorovich in 1934, it was continued by O. M. Nikodym in 1938, E. Marczewski in 1939, A. Banach in 1940 and many others. A. Rényi in his book on Foundation of Probability presents a nice short proof of the equivalence (in certain sense) of these notions.

The notion of qualitative independence was generalized in 1998 by P. Bártfai and T. Rudas to *conditional qualitative independence.*

It turns out that the existence of maximum likelihood estimations in loglinear models also fits into these set of problems.

In the talk we first focus on the case when the σ-fields are generated by atoms and later we discuss the general situation.

Peled, Ron (Tel Aviv University)
Random packings and liquid crystals
STOCHASTICS WITH INTERACTIONS
Tuesday, 21 June, 15:30-16:20, Small Lecture Hall

Abstract: Let T be a subset of $\mathbb{R}^d$, such as a ball, a cube or a cylinder, and consider all possibilities for packing translates of T, perhaps with its rotations, in some bounded domain in $\mathbb{R}^d$. How does a typical packing of this sort look like? One mathematical formalization of this question is to fix the density of the packing and sample uniformly among all possible packings with this density. Discrete versions of the question may be formulated as choosing a random independent set in a suitable lattice graph.The question arises naturally in the sciences, where T may be thought of as a molecule

and its packing is related to the spatial arrangement of molecules of a material under given conditions. In some cases, the material forms a liquid crystal - states of matter which are, in a sense, between liquids and crystals.I will review ideas from this field, mentioning some of the predictions and the mathematical progress. Time permitting, I will elaborate on a recent result, joint with Daniel Hadas, on the structure of high-density packings of 2×2 squares with centers on the square lattice. The talk is meant to be accessible to a general mathematical audience.

Pintz, János (Rényi Institute)
On the number-theoretic works of Alfréd Rényi
Plenary
Monday, 20 June, 11:30-12:20, Festive Hall

Abstract: We cover a few aspects of Rényi's work in Number Theory and later developments of it. We will deal with his greatest discovery in Number Theory, the Rényi-Linnik large sieve and its application to the quasi-Goldbach problem. We briefly sketch three more areas of his number-theoretic work: the so called Shanks-Rényi race problem on the distribution of primes in arithmetic progressions, his work with Erdős about consecutive gaps between primes and his work with Turán in probabilistic number theory, yielding an improvement of the error term in the celebrated Erdős-Kac theorem.

Pollicott, Mark (University of Warwick)
What is the difference between the Lagrange and Markoff spectra?
ENTROPY AND DIMENSION
Monday, 20 June, 14:10-15:00, Large lecture hall

Abstract: The Lagrange spectrum L and Markoff spectrum M are two subsets of the real line which arise in number theory. Despite their somewhat different definitions, L is contained in M and the set theoretic difference $M \setminus L$ has zero Lebesgue measure. We will describe some bounds on the Hausdorff dimension of this difference.

Samoti, Wojciech (Tel Aviv University)
Large deviations in random graphs
RANDOM GRAPHS AND NETWORKS 1.
Thursday, 23 June, 15:30-16:20, Large lecture hall

Abstract: Suppose that $Y_1, \ldots, Y_N$ are i.i.d. (independent identically distributed) random variables and let $X = Y_1 + \ldots + Y_N$. The classical theory of large deviations allows one to accurately estimate the probability of the tail events $X < (1-c)\mathbb{E}[X]$ and $X > (1+c)\mathbb{E}[X]$ for any positive c. However, the methods involved strongly rely on the fact that X is a linear function of the independent variables $Y_1, \ldots, Y_N$. There has been considerable interest –both theoretical and practical– in developing tools for estimating such tail probabilities also when X is a nonlinear function of the Y_i. One archetypal example studied by both the combinatorics and the probability communities is when X is the number of triangles in the binomial random graph $G(n,p)$. I will discuss recent developments in the study of the tail probabilities of this random variable. The talk is based on joint works with Matan Harel and Frank Mousset and with Gady Kozma.

Sasada, Makiko (University of Tokyo)
KdV- and Toda-type discrete locally-defined dynamics and generalized Pitman's transform
ERGODIC THEORY AND DYNAMICAL SYSTEMS
Thursday, 23 June, 14:10-15:00, Small Lecture Hall

Abstract: The Korteweg-de Vries equation (KdV equation) and the Toda lattice are typical and well-known classical integrable systems. For the KdV equation, the (almost-sure) well-posedness of a solution starting from a general ergodic random field on the line is still an open problem, though the invariance, as well as the well-posedness of a solution, of the white noise was proved recently by Killip, Murphy and Visan recently. In this talk, I will consider discretized versions of KdV equation and Toda lattice on the infinite one-dimensional lattice. These systems are understood as "deterministic vertex model", which are discretely indexed in space and time, and their deterministic dynamics is defined locally via lattice equations. They have another formulation via the generalized Pitman's transform, which is a new and crucial observation for our result. We show that there exists a unique solution to the initial value problem when the given data lies within a certain class, which includes the support of many shift ergodic measures. Also, a detailed balance criterion is presented that, amongst the measures that describe spatially independent and identically/alternately distributed configurations, characterizes those that are temporally invariant in distribution. This talk is based on a joint work with David Croydon and Satoshi Tsujimoto.

Shcherbina, Mariya (Kharhov University)
Super symmetry approach to the analysis of Genibre ensemble
Plenary
Wednesday, 22 June, 10:30-11:20, Festive Hall

Abstract: We consider a complex Ginibre ensemble of random matrices with deformation $H = H_0 + A$, where H_0 is a Gaussian complex Ginibre matrix and A is a rather general deformation matrix. The analysis of such ensemble is motivated by many problems of random matrix theory and its applications. We use of the Grassmann integration methods to obtain integral representation of spectral correlation functions of the ensemble and discuss the analysis of these functions with a saddle point method. Applications of the results of such an analysis to the problems of global and local regimes of the deformed Ginibre ensemble will be discussed.

Shmerkin, Pablo (Universidad Torcuato di Tella, Buenos Aires)
Entropy in geometric measure theory
ENTROPY AND DIMENSION
Monday, 20 June, 16:30-17:20, Large lecture hall

Abstract: I will discuss some (older and newer) applications of Shannon entropy to problems in geometric measure involving dimension (but no a priori dynamical structure).

Steger, Angelika (ETH Zurich)
Resilience of Random Graphs
RANDOM GRAPHS AND NETWORKS 1.
Thursday, 23 June, 14:10-15:00, Large lecture hall
Abstract: Suppose a random graph $G(n,p)$ satisfies some property P with high probability. How much power does an adversary need in order to destroy this property. The study of such questions within the theory of random graphs was initiated by Sudakov and Vu in 2008. In this talk we provide an overview of our results and open problems in this area.

Szegedy, Márió (Rutgers University)
The Polygamy of Entanglement
QUANTUM INFORMATION THEORY
Tuesday, 21 June, 16:30-17:20, Reading room

Abstract: Quantum entanglement is famously monogamous, i.e. if Alice, Bob and Cecil share a quantum state, and if Cecil is entangled with either Alice or Bob, then Alice and Bob cannot be entangled with each other. One however carefully has to read the fine print that comes with the definition, namely: "The parties are not allowed to send classical information after they make a measurement." The situation dramatically changes, when Cecil, after measuring her state, can send the result of the measurement to Alice and Bob Then, depending on the initial tripartite state between Alice, Bob and Cecil, the former two can retain entanglement, the amount of which, besides the initial state, also depends on the basis in which Cecil does her local measurement. Thus, with added classical communication Cecil is in the position of choosing to "nurse" the entanglement between Alice and Bob, or to destroy it. To measure this capacity of Cecil we have developed the notion of entanglement nursing index, which turns out to be the same notion as that of the localizable entanglement by Verstraete, Popp and Cirac. We explain this notion and some challenging questions related to it. (Joint with Sergey Bravyi, Yash Sharma and Ronald de Wolf.)

Tomamichel, Marco (University of Technology Sydney)
Quantum Rényi divergence and beyond
QUANTUM INFORMATION THEORY
Tuesday, 21 June, 15:30-16:20, Reading room

Abstract: I will give a tour of quantum generalisations of Rényi's entropy and divergence and various notions of conditional entropy and mutual information based on Rényi divergence. A particular focus will be on the non-uniqueness of such generalisations and interesting questions that arise from it, as well as operational interpretations of some Rényi information measures.

Tyagi, Himanshu (IIS Bangalore)
TBA

INFORMATION THEORY (CLASSICAL)
Monday, 20 June, 16:30-17:20, Small Lecture Hall

Valkó, Benedek (University of Wisconsin, Madison)
The stochastic zeta function
STOCHASTICS WITH INTERACTIONS
Tuesday, 21 June, 16:30-17:20, Small Lecture Hall

Abstract: Chhaibi, Najnudel and Nikhekgbali recently introduced a random entire function with zero set given by the points of the Sine_2 process, the point process limit of the circular unitary ensemble (CUE). They showed that the function is the limit of the normalized characteristic polynomials of the CUE. We provide new descriptions for this random function: as a power series built from Brownian motion, as a determinant connected to a random differential operator, and as the stationary solution of a stochastic differential equation. Our approach extends to various generalizations of the CUE: the circular beta ensemble, the circular Jacobi ensemble and the truncated circular beta-ensemble. Joint with Bálint Virág (Toronto) and Yun Li (University of Wisconsin - Madison).

Varjú, Péter (University of Cambridge)
Random polynomials and random walks
NUMBER THEORY
Monday, 20 June, 16:30-17:20, Reading room

Abstract: I will talk about two problems and their connection. The first problem is concerned with the probability that a random polynomial is irreducible. We will consider the model of random polynomials where the coefficients are independent and have a fixed distribution while the degree goes to infinity. The second problem is concerned with random walks in finite fields whose steps consist of multiplication by a deterministic element followed by addition of a random element drawn from a fixed distribution.

Virág, Bálint (Toronto)
Bisectors in random plane geometry
Plenary
Thursday, 23 June, 10:30-11:20, Festive Hall
Abstract: In Euclidean geometry, bisectors are perpendicular lines. What happens in a random geometry? Surprisingly, many features are not sensitive to which model we use. There is a universal random geometry and its bisectors help answer some open questions in particle systems.

Werner, Wendelin (ETH Zurich)
On conformal loop ensembles
Plenary
Wednesday, 22 June, 9:00-9:50, Festive Hall

Abstract: I will survey recent (and less recent) results about Conformal Loop Ensembles – and their properties.

Winter, Andreas (Universitat Autònoma de Barcelona)
Entropy inequalities: beyond strong subadditivity?
Plenary
Tuesday, 21 June, 9:00-9:50, Festive Hall

Abstract: What are the constraints that the von Neumann entropies of the 2^n possible marginals of an nparty quantum state have to obey? Similarly for the Shannon entropy of n random variables? Pippenger called these "the laws of (quantum) information theory", among them subadditivity and strong subadditivity, and while we know a few of them, we seem to me missing many. In fact, it is known that both classically and quantumly, the set of entropy vectors is essentially a convex cone, so the laws in question naturally take the form of homogeneous convex inequalities, More specifically, we can describe the classical and entropy cones for n parties by linear information inequalities.

Starting with Zhang and Yeung, Dougherty et al. and finally Matus have shown that 4-partite Shannon entropies satisfy infinitely many inequalities beyond the standard ones, the "Shannon inequalities", which define a polyhedral cone. Matus's result implies that the entropy cone of 4 random variables is not polyhedral.

In the talk I will review progress towards finding non-von-Neumann inequalities in the quantum case, commenting on the case of Rényi entropies as well.

Young, Lai Sang (NYU)
The brain is a dynamical system
Plenary
Thursday, 23 June, 11:30-12:20, Festive Hall

Abstract: In the human brain, tens of billions of neurons communicate with one another mostly via electric impulses. This is often modeled as a coupled dynamical system, a large network the nodes of which are smaller subsystems describing the dynamics of individual neurons. Neuroscience is much more than such a network, to be sure: there are complicated biochemical processes, and the ultimate goal is to understand cognition and behavior. But neuronal dynamics are an integral part of brain function, and mathematics – dynamical systems in particular – can shed light on biologically meaningful models of such interactions. In this talk, I would like to use primate vision to illustrate this partnership between mathematics and neuroscience. I will focus on input regions of the visual cortex, and discuss dynamic mechanisms behind two of our crucial visual functions: the detection of edges that are building blocks of contours of objects, and the tracking of moving targets.