SwissMAP Annual General Meeting

September 11 – September 14, 2022

Les Diablerets
(Maison des Congrès)

Tommaso Maria BOTTA (ETH Zurich)

Title: Shuffle algebra structure for stable envelopes

Abstract: *The notion of stable envelopes of a symplectic resolution, developed by Okounkov and his coauthors in the last decade, lies at the heart of the geometric approach to the representation theory of quantum groups and q-difference equations. Nakajima quiver varieties form a rich family of symplectic resolutions, whose geometry governs the representation theory of Kac-Moody Lie algebras and, via stable envelopes, their q-deformations. In this talk, I will introduce an inductive formula that produces the stable envelopes of an arbitrary Nakajima variety, taking as input the stable envelopes of two other Nakajima varieties with smaller dimension and framing vectors. Some explicit examples will be also discussed. This formula is a wide generalisation earlier results inherited form the theory of weight functions. Time permitting, I will also discuss connections with cohomological Hall algebras (CoHa) and Cherkis bow varieties in relation to 3d Mirror symmetry, which are object of ongoing research.*

Alberto CATTANEO (University of Zurich)

Title: Poisson structures from corners of field theories

Abstract: *The BV formalism and its shifted versions in field theory have a nice compatibility with boundary structures. Namely, one such structure in the bulk induces a shifted (possibly degenerated) version on its boundary. I will discuss in particular how to proceed from the BFV structure on a "space" slice in field theory, which describes the symplectic reduction due to constraints), to a shifted structure on its boundary (the corners of space–time), which in turn describes a Poisson algebra (possibly up to homotopy). I will describe a few examples, including, time permitting, general relativity in the coframe formulation.*

Barbara DEMBIN (ETH Zurich)

Title: Some results in first passage percolation

Abstract: *Consider the graph $(\mathbb{Z}^d, \mathbb{E}^d)$ and some parameter $p \in [0,1]$. Let $(B_e)_{e\in\mathbb{E}^d}$ be an i.i.d. family of Bernoulli random variables of parameter p. Consider the random graph $\mathcal{G}_p$ where we only keep the edges such that $B_e = 1$. This is the model of percolation where the central question is the existence of an infinite connected component in $\mathcal{G}_p$ given the value of p.*
This model may be generalised by considering more general distributions on the edges. Let G be a distribution on $\mathbb{R}_+ \cup \{+\infty\}$ and $(t_e)_e$ be an i.i.d. family distributed according to G. This is the so-called model of first passage percolation. We can give two interpretations of the random variable t_e that lead to different questions. In a first interpretation, we consider that t_e represents the time to cross the edge e. There is then a natural way to define a random metric on the lattice, the main object of interest are the geodesics, that are the shortest paths. In a second interpretation, the random variable t_e represents a capacity. The capacity of an edge is the maximal amount of water that can cross the edge per second. In this context, we are interested in the large scale behaviour of the maximal amount of water that can flow through the lattice per second and the way the water circulates in the lattice.
We will present results on these two interpretations of first passage percolation and links with the model of percolation.

Victor GORBENKO (EPFL)

Title: Confinement: Past, Present and Future

Abstract: *I will discuss the phenomenon of quark confinement exhibited by quantum chromodynamics - the theory describing one of the four known fundamental forces of nature - as well as by more general non-abelian gauge theories. After reviewing some history of this rich subject, I will explain that the recent progress in understanding of it was achieved due to focusing on a specific object, a long confining string in pure Yang-Mills theory. I will then describe what are the prospects for "solving" confinement in the future.*

Anfisa GURENKOVA (University of Geneva)

Title: Cactus group and Yong tableaux

Abstract: *Let $\mathfrak{g}$ be a classical Lie algebra. There is a family of commutative subalgebras in $U_{\mathfrak{g}}$ over the Deligne-Mumford moduli space $M_{0,n+1}$ with the following properties:*

- *over the subset of configurations of n points on A^1 it coincides with the family Gaudin subalgebras,*
- *over the special points it coincides with Gelfand-Zeitlin subalgebras.*

Moreover, over the real locus $M_{0,n+1}(R)$ it acts with simple spectrum in the multiplicity space of the tensor product of any n irreducible finite-dimensional g-modules. Thus, for any $n+1$ dominant integer weights we have a covering of eigenlines over $M_{0,n+1}(R)$. The monodromy action of this covering gives us an action of the cactus group (=S_n-equivariant fundamental group of $M_{0,n+1}(R)$) on the fibers, which are parametrized by various kinds of Young tableaux over the special points. .

Qianyu HAO (University of Geneva)

Title: Exact WKB for difference equations and BPS states

Abstract: *4d $\mathcal{N}=2$ supersymmetric theories are known to be connected with differential equations. We study a specific example of $SU(2)$ $N_f = 1$ theory which corresponds to a Schrodinger equation. An important quantity to study in the exact WKB analysis of the Schrodinger equation is the quantum period, also known as the Voros symbol, which is defined as the Borel summation of the term by term integration of the formal WKB series solving the Schrodinger equation. There are 3 other equivalent definitions of quantum periods, including the holonomy, the TBA equations of Gaiotto-Moore-Neitzke/Gaiotto, and using instanton counting. In particular, instanton counting provides an analytic solution to the TBA equation. Similarly 5d N=1 theories compactified on a circle are connected to difference equation. We study the 5d theory given by the resolved conifold and here open topological string partition functions provide resummations of the WKB series solving difference equation.*

Mikaela IACOBELLI (ETH Zurich)

Title: Stability and singular limits in plasma physics

Abstract: *In this colloquium we will present two kinetic models that are used to describe the evolution of charged particles in plasmas: the Vlasov-Poisson system and the Vlasov-Poisson system with massless electrons. These systems model respectively the evolution of electrons, and ions in a plasma. We will discuss the well-posedness of these systems, the stability of solutions, and their behaviour under singular limits.*
Finally, we will introduce a new class of Wasserstein-type distances specifically designed to tackle stability questions for kinetic equations.

Christoph KEHLE (ETH Zurich)

Title: An unexpected small divisors instability in general relativity

Abstract:

Rafael MOSER (University of Bern)

Title: Convexity, large charge and the large N Φ^4 theory

Abstract: *I will discuss the $O(2N)$ vector model with a quartic interaction at leading order in N, in a setting that allows for large charge methods to be deployed. I will then discuss the phase space in dimensions $D = 3$ and $D = 5$ based on the convexity properties of the grand potential. We find very different behaviour in the two cases: While in $D = 3$, the theory is well-behaved, the model in $D = 5$ leads to a complex CFT in the UV. We also find a new metastable massive phase in the high-energy regime for the theory on the cylinder.*

Pietro PELLICONI (University of Geneva)

Title: Sailing past the Edge and discovering an Island

Abstract: *Large black holes in anti-de Sitter space have positive specific heat and do not evaporate. In order to mimic the behavior of evaporating black holes, one may couple the system to an external bath. In this talk I will explore a rich family of such models, namely ones obtained by coupling two holographic CFTs along a shared interface (ICFTs). We focus on the limit where the bulk solution is characterized by a thin brane separating the two individual duals. These systems may be interpreted in a double holographic way, where one integrates out the bath and ends up with a lower-dimensional gravitational braneworld dual to the interface degrees of freedom. Our setup has the advantage that all observables can be defined and calculated by only relying on standard rules of AdS/CFT. We exploit this to establish a number of general results, relying on a detailed analysis of the geodesics in the bulk. We prove that the entropy of Hawking radiation in the braneworld is obtained by extremizing the generalized entropy, and moreover that at late times a so-called 'island saddle' gives the dominant contribution. We also derive Takayanagi's prescription for calculating entanglement entropies in BCFTs as a limit of our ICFT results.*

Iuliia POPOVA (University of Geneva)

Title: Semi-classical conformal blocks and AdS_3/CFT_2 correspondence

Abstract:

Alexandre REGE (ETH Zurich)

Title: Well-posedness for the magnetized Vlasov-Poisson system

Abstract: *The Vlasov-Poisson system with external magnetic field is a classic model used to describe plasmas. I will review recent results regarding propagation of velocity moments and uniqueness for weak solutions to this system.*

Biswajit SAHOO (EPFL)

Title: Classical soft graviton theorem and gravitational tail memory

Abstract:

Adrian SANCHEZ GARRIDO (University of Geneva)

Title: Phenomenology of Krylov Complexity

Abstract: *Krylov complexity is a notion of complexity that characterizes the spread of an operator over the algebra of observables by measuring its projection over a suitable orthonormal basis of this algebra built out of nested commutators of the Hamiltonian with the operator. Using this basis, operator dynamics can be mapped to a one-dimensional hopping problem. In this talk I will present recent results on the time evolution of Krylov complexity away from the thermodynamic limit for both chaotic and integrable systems. While the former display the complexity profile expected in the context of the butterfly effect in AdS/CFT, the latter feature a late-time suppression of complexity due to an enhanced localization effect in the afore-mentioned hopping problem. I will illustrate this phenomenology by analyzing a system that is able to interpolate between integrable and chaotic regimes.*

Aleksandr TRUFANOV (University of Geneva)

Title: Highest-weight vectors and three-point functions in coset decomposition

Abstract: *We revisit the classical coset construction* $\widehat{\mathfrak{sl}}(2)_1 \oplus \widehat{\mathfrak{sl}}(2)_k$. *We find the formulas for the highest weight vectors in coset decomposition and calculate their norms. We also derive formulas for matrix elements of certain vertex operators between these vectors. The results were motivated by the Nekrasov approach to the Kiev formulas for the Painlevé tau-functions.*

Vincent VARGAS (University of Geneva)

Title: Liouville conformal field theory: from the probabilistic construction to the bootstrap construction

Abstract: *Liouville field theory was introduced by Polyakov in the eighties in the context of string theory. Liouville theory appeared there under the form of a 2D Feynman path integral and since then has appeared in a wide variety of contexts (random conformal geometry, SUSY Yang-Mills, etc...). Recently, a rigorous probabilistic construction of the path integral was provided using the Gaussian Free Field. In this talk, I will review the probabilistic construction and its equivalence with the bootstrap construction used in the physics literature. The key steps in this equivalence is a probabilistic derivation of the DOZZ formula for the structure constants, the spectral analysis of the Hamiltonian of the theory and the proof that the probabilistic construction satisfies certain natural geometrical gluing rules called Segal's axioms. Based on numerous works with G. Baverez, F. David, C. Guillarmou, A. Kupiainen, R. Rhodes.*