

**New Trends in
Non-Perturbative
Gauge/String Theory and
Integrability**

**Rapport sur les
contributions**

ID de Contribution: 22

Type: **Non spécifié**

Factorizability of the partition function of the supermatrix model

mardi 28 juin 2022 11:00 (20 minutes)

In this talk we will focus on the supermatrix model which can be seen as a specific case of two-matrix models. The former has been introduced long time ago and it has been noticed or suggested that its properties might not drastically differ from ordinary one-matrix model, at least in the planar limit. We want here to present how the partition function of the supermatrix model actually differs from the ordinary one and how its factorized form can lead to further questions in terms of non-planar graphs and perturbative corrections. To illustrate these problems we will make connection with the Fermi gas description of ABJ theory introduced by Marino and Putrov.

Orateur: BABINET, Nicolas (IMB)

ID de Contribution: 23

Type: **Non spécifié**

Shifted quantum groups and matter multiplets in supersymmetric gauge theories

lundi 27 juin 2022 14:00 (50 minutes)

Orateur: BOURGINE, Jean-Emile (Melbourne)

ID de Contribution: 24

Type: **Non spécifié**

Insights from the quantum modularity of 3-manifold invariants

mardi 28 juin 2022 11:50 (50 minutes)

A recently proposed class of topological 3-manifold invariants $Z^{\wedge}[M]$ which admit series expansions with integer coefficients has been a focal point of much research over the past few years, proving themselves ubiquitous in a wide range of contexts. They were originally defined physically as an index which computes the BPS spectra of certain supersymmetric quantum field theories in three dimensions, and associated to 3-manifolds M through the 3d-3d correspondence. Mathematically, they have also been shown to possess curious number-theoretic features, giving examples of quantum modular forms. After reviewing some of these new developments, here I explore certain higher rank extensions and highlight emerging features of the corresponding Z^{\wedge} invariants, such as nested relations with respect to their rank and a hidden modular structure.

Orateur: COMAN, Ioana (Amsterdam)

ID de Contribution: 25

Type: **Non spécifié**

From SUSY gauge theories to generalized cohomology to Bethe ansatz

mardi 28 juin 2022 14:00 (50 minutes)

Supersymmetric ground states and supersymmetric boundary conditions in gauge theories with four supercharges are related to equivariant cohomology theories of their spaces of vacua. When we focus on 3d theories compactified on the elliptic curve, the relevant cohomology theory is elliptic, and upon degenerations to 2d and 1d it reduces to K-theory and de Rham cohomology. Via this connection, certain geometric constructions of stable envelopes due to Okounkov and collaborators receive interpretations as supersymmetric interfaces in gauge theories. The linear actions of infinite-dimensional Hopf algebras (Yangians, quantum loop, and elliptic) on the cohomology, constructed via stable envelopes in the literature, are interpreted as actions on the ground states of families of quantum field theories. Some of the generators are realized as interfaces between different QFTs in a family. These structures underlie what is known as the Bethe/Gauge correspondence of Nekrasov-Shatashvili, in which the space of supersymmetric ground states of a family of QFTs is identified with the Hilbert space of a certain integrable model. I will review some of the developments in this area.

Orateur: DEDUSHENKO, Mykola (SCGP)

ID de Contribution: 26

Type: **Non spécifié**

Donaldson-Thomas invariants of toric quivers

jeudi 30 juin 2022 10:30 (20 minutes)

A toric localization formula for numerical Donaldson-Thomas invariants, giving the virtual Euler number of moduli spaces which are critical loci, is known since Graber and Pandharipande. We provide here a refining of this formula for cohomological Donaldson-Thomas invariants, which can be seen as a 'virtual version of Bialinicky Birula decomposition', giving the virtual cohomology of the attracting variety as a shifted sum of the virtual cohomology of the fixed components. We show how this formula gives a refining of the computation of numerical DT invariants of toric quivers by enumerating pyramids provided by Mozgovoy and Reineke.

Orateur: DESCOMBES, Pierre (Sorbonne)

ID de Contribution: 27

Type: **Non spécifié**

Super-Macdonald polynomials: Orthogonality properties and physical interpretations

vendredi 1 juillet 2022 11:50 (50 minutes)

Macdonald polynomials are two-parameter generalizations of Schur polynomials, with important connections to representation theory, geometry as well as integrable systems. In particular, they provide eigenfunctions of Macdonald-Ruijsenaars difference operators, which define an integrable relativistic quantum many-body system. This talk is focused on the so-called super-Macdonald polynomials, which generalize the Macdonald polynomials to two kinds of variables and formally provide eigenfunctions of the deformed Macdonald-Ruijsenaars operators first introduced by Chalykh and Sergeev and Veselov. I will present somewhat non-standard orthogonality properties of the super-Macdonald polynomials, a related Hilbert space interpretation and raise the question of possible physical interpretations.

Orateur: HALLNÄS, Martin (Chalmers)

ID de Contribution: 28

Type: **Non spécifié**

What can little strings teach us about the geometric Langlands program?

lundi 27 juin 2022 11:50 (50 minutes)

In its simplest incarnation, the geometric Langlands program was defined by Beilinson and Drinfeld in the late 90's as relating, on one side, a flat connection on a Riemann surface, and on the other side, a more sophisticated structure known as a D-module. Since its inception, this conjectured correspondence has been a highly active and fruitful topic of research both for mathematicians and theoretical physicists. In this talk, we will review a generalization of the correspondence known as the quantum q -Langlands program, due to Aganagic-Frenkel-Okounkov, which establishes an isomorphism between q -deformed versions of conformal blocks, for a W -algebra on one side, and a Langlands dual affine Lie algebra on the other side. We will then extend the correspondence, and invoke physical arguments from six-dimensional little string to give a precise mathematical formulation of ramification, or adding punctures on the Riemann surface in the q -Langlands program. We will also comment on the CFT limit; for instance, when the Lie algebra is specialized to be $\mathfrak{sl}(2)$, one obtains a new (dual) perspective on recent results of Nekrasov and Tsybaliuk.

Orateur: HAOUZI, Nathan (IAS)

ID de Contribution: 29

Type: Non spécifié

Diagrammatic Expansion of Non-perturbative Little String Free Energies

lundi 27 juin 2022 10:00 (50 minutes)

Diagrammatic Expansion of Non-perturbative Little String Free Energies

Abstract: In this talk I discuss the non-perturbative free energy of a class of Little String Theories of A-type, which are engineered by N parallel M5-branes on a circle. Exploiting non-perturbative symmetries of these theories, I provide evidence to leading instanton order (from the perspective of the low energy $U(N)$ gauge theory) for a decomposition, which resembles a Feynman diagrammatic expansion: external states are given by expansion coefficients of the $N = 1$ BPS free energy and a quasi-Jacobi form that governs the BPS-counting of an M5-brane coupling to two M2-branes. The effective coupling functions can be written as a simple combination of two-point functions of a single free scalar field on the torus. To further instanton orders, a decomposition of the free energy in terms of higher point functions with the same external states is still possible but a priori not unique. The loop corrections appearing in this picture can be linked to dihedral graph functions with bivalent vertices, which suggests an interpretation in terms of disconnected graphs.

Orateur: HOHENEGGER, Stefan (Lyon)

ID de Contribution: 30

Type: **Non spécifié**

Black hole perturbations from Liouville correlators

mardi 28 juin 2022 10:30 (20 minutes)

Reversing the logic of the bootstrap approach in Liouville CFT we explicitly compute the connection formulae for degenerate conformal blocks. In the semiclassical limit of the theory, this amounts to solving the connection problem of Fuchsian ODEs. Generalizing to irregular insertions we solve as well for various confluences. Concentrating on the Heun equations, we can solve the wave equations of a large class of gravitational backgrounds. Indeed, when the wave equation of a black hole or a microstate is separable, it often reduces to Heun equations, and exact connection formulae give access to several quantities. We consider a 4d Kerr black hole and an AdS5 spherically symmetric black hole and compute relevant objects. Crucially, everything is computed in terms of combinatorial objects exploiting the AGT duality.

Orateur: IOSSA, Cristoforo (SISSA)

ID de Contribution: 31

Type: **Non spécifié**

Testing 3d IR Dualities Using Algebraic Geometry

jeudi 30 juin 2022 11:00 (20 minutes)

In this talk I will revisit some well-studied 3d IR dualities including Aharony Duality and that of Giveon-Kutasov. I will also discuss some recently proposed ones and show how one can connect these dualities together. In the second part, I will show how, using algebraic geometry and supersymmetric localization, one can explicitly compute the twisted supersymmetric index on any Riemann surface. One can then test these dualities by matching twisted indices on both sides of the duality. Background Chern-Simons terms play a crucial role in this story.

Orateur: KHLAIF, Osama (Birmingham)

ID de Contribution: 33

Type: **Non spécifié**

The Geometry of Magnificent Four

jeudi 30 juin 2022 14:00 (50 minutes)

Motivated by super-Yang–Mills theory on a Calabi–Yau 4-fold, Nekrasov and Piazzalunga assigned weights to r -tuples of solid partitions (4-dimensional piles of boxes) and conjectured a formula for their weighted generating function. We define K-theoretic virtual invariants of Quot schemes of 0-dimensional quotients of \mathcal{O}_r on affine 4-space by realizing them as zero loci of isotropic sections of orthogonal bundles. Using the Ok–Thomas localization formula, we recover Nekrasov–Piazzalunga’s weights. Applying ideas from Okounkov in the 3-dimensional case, we prove Nekrasov–Piazzalunga’s formula. Joint work with J. Rennemo.

Orateur: KOOL, Martijn (Utrecht)

ID de Contribution: 34

Type: **Non spécifié**

Branes and DAHA Representations

vendredi 1 juillet 2022 09:30 (50 minutes)

Orateur: KOROTEEV, Peter (Berkeley)

ID de Contribution: 35

Type: **Non spécifié**

Irrelevant deformations by higher-form symmetries

mercredi 29 juin 2022 11:50 (50 minutes)

Zamolodchikov and Smirnov discovered how 2d QFTs can be deformed by an antisymmetric combination of two conserved currents. The landmark example is the $\mathbb{T}\bar{\mathbb{T}}$ deformation constructed from the stress tensor. After explaining which symmetries these deformations preserve, I will explain higher-dimensional generalizations based on higher-form symmetries. This leads to a curious way to couple a compact scalar field to any theory with $U(1)$ flavour symmetry.

Orateur: LE FLOCH, Bruno (Sorbonne)

ID de Contribution: 36

Type: **Non spécifié**

Bethe ansatz solution for a new integrable open quantum system

mercredi 29 juin 2022 11:00 (20 minutes)

In nature, the interaction of a system with the environment cannot be avoided. If the response of the environment is Markovian, the density matrix will evolve through the Lindblad Master equation: dependent on the Hamiltonian of the system and a jump operator describing the coupling to the environment. In PRL 126.24 (2021): 240403, we gave a partial classification of Yang Baxter Integrable interacting systems, including several new models with interesting features. In this talk, I will focus on one of the models (model B3): I will give the analytical expression of the Non Equilibrium steady states and also its physical properties. I will also show how to solve this model via the nested Algebraic Bethe Ansatz method.

Orateur: PALETTA, Chiara (Trinity)

ID de Contribution: 37

Type: **Non spécifié**

Dendrospectroscopy of BPS states

jeudi 30 juin 2022 09:30 (50 minutes)

The spectrum of BPS states in D=4 supersymmetric field theories and string vacua famously jumps across codimension-one walls in vector multiplet moduli space. The Attractor Flow Tree conjecture postulates that the BPS index $\Omega(\gamma, z)$ for given charge γ and moduli z can be reconstructed from the “attractor indices” $\Omega(\gamma_i)$ counting BPS states of charge γ_i in their respective attractor chamber, by summing over all possible decompositions $\gamma = \sum_i \gamma_i$ and over stable decorated rooted flow trees. Physically, flow trees provide a mesoscopic representation of BPS states as nested multi-centered bound states of elementary constituents. I will present a rigorous version of this formula in the context of quiver quantum mechanics, which governs the BPS spectrum in type IIA string theory compactified on certain conical Calabi-Yau threefolds, in the vicinity of orbifold-type points in Kahler moduli space. Moving away from such orbifold points requires generalizing the flow tree formula from the Abelian category of quiver representations to the derived category of the same. I will present recent progress in this direction in the simplest case of local P2, and argue that its global BPS spectrum and flow tree structure can be deduced from a scattering diagram with simple initial data.

Orateur: PIOLINE, Boris (Sorbonne)

ID de Contribution: 39

Type: **Non spécifié**

Non-semisimple TQFTs and BPS q-series

mardi 28 juin 2022 09:30 (50 minutes)

In my talk I will describe a relation between the 3d Topological Quantum Field Theories (TQFTs) of Blanchet–Costantino–Geer–Patureau–Mirand, constructed from a non-semisimple category of representations of a quantum group, and counting of BPS states in a 6d (2,0) superconformal field theory compactified on a 3-manifold with a topological twist.

Orateur: PUTROV, Pavel (ICTP)

ID de Contribution: 40

Type: **Non spécifié**

XYZ correlations and Painlevé VI

mercredi 29 juin 2022 09:30 (50 minutes)

Baxter solved the XYZ spin chain in the sense of computing the free energy in the infinite lattice limit. For special parameter values, the chain has an underlying supersymmetry. It is then possible to obtain exact results even for finite size systems. In the special case of the XXZ chain, this is related to very interesting combinatorics (e.g. the alternating-sign-matrix and Razumov-Stroganov ex-conjectures). For the more general XYZ spin chain, less is known. We will describe how nearest neighbour correlations for finite length supersymmetric XYZ spin chains can be computed explicitly in terms of tau functions of Painlevé VI. This is joint work with Christian Hagendorf (Louvain-la-Neuve).

Orateur: ROSENGREN, Hjalmar (Chalmers)

ID de Contribution: 41

Type: **Non spécifié**

Equivariant indices and geometry

jeudi 30 juin 2022 11:50 (50 minutes)

Orateur: ZABZINE, Maxim (Uppsala)

ID de Contribution: 42

Type: **Non spécifié**

Refined topological strings and qq-characters

vendredi 1 juillet 2022 10:30 (50 minutes)

Using the identification of certain topological string amplitudes with R-matrices of Ding-Iohara-Miki algebras we find that qq-characters can be constructed in a very simple way from degeneration of certain open refined topological string amplitudes. We illustrate the construction with several examples.

Orateur: ZENKEVICH, Yegor (SISSA)

ID de Contribution: 43

Type: **Non spécifié**

Random partitions and gauge group integrals: recent results

lundi 27 juin 2022 11:00 (20 minutes)

Random matrix integrals have a natural connection with the Schur measure on random partitions. In this talk I briefly highlight recent work in this direction, in particular focusing on a generalization of the Gross-Witten-Wadia model to classical gauge groups.

Auteur principal: PURKAYASTHA , Souradeep (IMB)

Orateur: PURKAYASTHA , Souradeep (IMB)

ID de Contribution: 45

Type: **Non spécifié**

Explicit computations for spin chains and the remarkable operator Co-derivative

mercredi 29 juin 2022 10:30 (20 minutes)

In this talk, we are going to show the power of the operator Co-derivative in converting complicated computations into combinatorial relation. To do so, I will consider the twisted spin chain with the underlying Lie algebra $\mathfrak{gl}(n)$, and show how to obtain the (T,Q) operators using the D-diagrams that arise from using the Co-derivative on the generating series of the characters. Then, we will consider the case when the underlying Lie algebra is $\mathfrak{so}(2n)$, show how the operator Co-derivative changes in this case and find the (T,Q) operators in the symmetric case.

Orateur: ALDARAK, Helal (IMB)