

XMath Physics Day

Rapport sur les contributions

ID de Contribution: 1

Type: Non spécifié

From Categorical Enumerative Invariants towards Twisted Holography

mercredi 17 décembre 2025 10:00 (1 heure)

We will introduce (closed) Categorical Enumerative Invariants (CEI), developed by Kontsevich, Costello, Caldararu-Tu, mentioning how they are an algebraic generalisation of Kodaira-Spencer gravity (BCOV theory). Next, we describe the algebra relevant to the theory of open CEI, which is related to Chern-Simons theory, and highlight some results obtained by the speaker. Lastly, we comment on work in progress on how these ideas may be used to understand statements such as Gopakumar-Vafa duality on the relation between Gromov-Witten invariants of the resolved conifold and Chern-Simons theory on S^3 .

Orateur: M. ULMER, Jakob (Paris 13)

ID de Contribution: 2

Type: Non spécifié

A Topological Recursion Algorithm for WKB Solutions

mercredi 17 décembre 2025 14:30 (1 heure)

We develop a version of the Topological Recursion (TR) algorithm for WKB solutions of polynomial linear differential equations dependent on a parameter \hbar , focusing on cases where the associated spectral curve admits only simple ramification points. This new algorithm hinges on the geometric description of a specific, universally defined orbit of an infinite-dimensional Lie group acting on an infinite-dimensional vector space of Laurent series. By taking the intersection of this orbit with a carefully chosen complementary space to its tangent space, we obtain a unique formal WKB solution for the given differential equation.

Orateur: Mme REN, Irene (IHES)

Resurgent integrals

mercredi 17 décembre 2025 16:00 (1 heure)

I will discuss a framework of resurgence using constructible sheaves and how algebraic exponential integrals can be described in this framework. Then I will discuss generalization leading to applications for knots.

Orateur: M. WHEELER, Campbell (IHES)

ID de Contribution: 4

Type: Non spécifié

BPS counting and Resurgence of Topological Strings

mercredi 17 décembre 2025 11:00 (1 heure)

The Topological String free energy is an asymptotic perturbative series associated with a specific geometry, typically a Calabi-Yau manifold or a spectral curve. This series encodes important geometric invariants of the corresponding geometry. Physically, the topological string free energy can be interpreted as a sum of amplitudes involving super-symmetric (BPS) particles.

The theory of Resurgence is the right mathematical framework to analyse such asymptotic series. In particular, Resurgence analysis provides analytical and numerical tools to make sense of such divergent series and to re-sum them, providing natural non-perturbative completions to the given theory.

In this talk, I will show what we can uncover by applying the tools of Resurgence to the study of the Topological Strings on compact Calabi-Yau manifolds. In particular, we numerically found that, for any deformations of the underlying geometry, the resurgence analysis of the Topological String naturally encodes invariants associated with BPS particles, even in situations where we do not have a good physical and/or geometrical control.

Orateur: M. DOUAUD, Simon (LPENS)

ID de Contribution: 5

Type: Non spécifié

Large orders and Resurgence in Functional Renormalization

mercredi 17 décembre 2025 13:30 (1 heure)

The resummation of perturbative expansions of Quantum Field Theories has been studied extensively in the case when there are only a few coupling constants, with no results yet for functional field theories (FFT), where all powers of interaction remain relevant under the renormalization group flow.

We address this gap by examining the large-order behaviour (LOB) of a functional field theory describing disordered elastic manifolds in equilibrium.

This FFT involves two fields ϕ and $\tilde{\phi}$ and a control parameter w which sets the expectation value $\langle \phi \rangle = w$. To understand how we can gain non-perturbative access to the functional fixed point, we considered the zero-dimensional limit ($d \rightarrow 0$). This “toy” model reveals a surprisingly rich complexity: the standard saddle-point method fails to yield the correct asymptotics due to the non-analyticity of the Borel sum.

To resolve this problem, we used the fact that each term of the perturbative expansion can be rewritten as a contour integral circling the origin. This allows us to resum the series and reach the strong coupling limit. However, this approach only works in $d = 0$ dimensions. For $d > 0$ we could use a saddle-point method to obtain the LOB. This method has problems even in $d = 0$: the action at the saddle point corresponding to the closest singularity in the Borel plane develops a branch cut for positive values of $w > 0.31$. As a result, the inverse Borel transform acquires a complex ambiguity. The resolution requires resurgence theory, where this complex contribution is cancelled by non-perturbative corrections obtained from the discontinuity of the Borel sum (the Stokes jump).

Orateur: M. SEMEYKIN, Mikhail (LPENS)