SRS
SwissMAP Research Station in Les Diablerets

Winter School 2024

January 7th – January 12th, 2024
Les Diablerets (Maison des Congrès)

Daniel ALVAREZ (University of Toronto)

Title: Generalized Kahler structures and double symplectic groupoids Kahler metrics are locally determined by a single real valued function on a manifold

Abstract: *This property extends to generalized Kahler manifolds but the general proof of this fact is significantly more complicated than in the Kahler case. I will give a brief overview of the ideas involved. This is joint work with Marco Gualtieri and Yucong Jiang.*

Jonah EPSTEIN (University of Bonn)

Title: Hopf algebra renormalization and algebraic quantum field theory

Abstract: *In this talk based on a joint project with David Prinz and Arne Hofmann, I explain how to apply the formalism about renormalization introduced by Connes-Kreimer to algebraic quantum field theory. Connes-Kreimer describe a Hopf algebra of Feynman graphs, such that the coproduct filters out all sub-divergencies. They obtain a map to a target algebra of formal integral expressions and a splitting into a divergent and a convergent part, called algebraic Birkhoff decomposition. Substracting the divergent part yields the renormalized Feynman rules. On the other hand, AQFT focuses on extending certain distributions to the diagonal, after Epstein-Glaser. Our main theorem shows that one can construct a target algebra and renormalized Feynman rules such that the distributions appearing in the perturbative expansion can be extended to the diagonal.*

Simon HEUVELINE (University of Cambridge)

Title: Deformations of Celestial Chiral Algebras

Abstract: *This talk is based on arXiv:2305.09451 and work in progress. I will discuss several deformations of gravitational celestial chiral algebras which are closely related to* $w_{1+\infty}$ *and give bulk interpretations of the respective deformations. Some of these deformations arise naturally from a backreaction in self-dual Einstein gravity analogous to part of the recent top-down construction of Costello, Paquette and Sharma and I will highlight similarities and differences.*

Thibault JUILLARD (Université Paris-Saclay)

Title: Reduction by stages for finite W-algebras

Abstract: *The dual vector space of a simple Lie algebra is a well-known example of Poisson variety. Given a nilpotent element in this Lie algebra, one can construct by Hamiltonian reduction another Poisson variety: the Slodowy slice associated to this nilpotent element. This variety admits a quantization by a noncommutative algebra, called finite W-algebra (see Gan and Ginzburg, 2002). In this talk, I will present a joint work with Naoki Genra about reduction by stages for Slodowy slices and finite W-algebras (arXiv:2212.06022). Given two nilpotent elements with some compatibility conditions, we prove that one of the two corresponding Slodowy slices is the Hamiltonian reduction of the other one. We also prove a quantum version of the statement: one W-algebra is the Hamiltonian reduction of the other one. If there is enough time, I will also present some nice applications: the Skryabin equivalence by stages or the construction of embeddings of W-algebras.*

Pedram KARIMI (University of Warsaw)

Title: The proof of superrintegrability in beta deformed matrix model

Abstract: *We can calculate multipoint correlation function of matrix model. These multipoint correlation functions can be written in different basis, also known as characters. Surprisingly there exist a basis that multipoint correlation function take a factorized form in it. The aim of this talk is to outline the algebraic proof for this character preservation property in beta deformed Gaussian eigenvalue models. Finally, by connecting the dots between superrintegrability and integrable hierarchy, we argue that in this framework character preservation comes naturally as a consequence of polynomial tau function*

Raffaele LOMARTIRE (University of Vienna)

Title: The asymptotically AdS3 GR to Liouville CFT reduction and its higher-spin generalization

Abstract: *It has been well known since the 1990s that pure 3-dimensional general relativity with negative cosmological constant can be reduced to a Liouville CFT, using the asymptotically AdS boundary conditions. This "correspondence" is rederived from first principles using the covariant phase space formalism. Furthermore, it is shown that this correspondence also holds for the higher-spin generalization of asymptotically AdS3 gravity, explicitly showing that the corresponding boundary theory is an sl(N) Toda CFT.*

Sid MAIBACH (University of Bonn)

Title: The conformal anomaly and Kähler geometry of moduli spaces of bordered Riemann surfaces

Abstract: *For conformal field theories on Riemann surfaces, the conformal anomaly describes the variation of the partition function under local rescalings of the metric. After introducing the moduli space of bordered Riemann surfaces, as it appears in Segal's formulation of the conformal bootstrap, I show how a reformulation of the conformal anomaly by Kontsevich and Suhov defines a real determinant line bundle over this moduli space. Despite this line bundle being trivial boundle, there is interesting structure in the behaviour of the determinant lines under gluing of Riemann surfaces along the boundary components. The aim of this talk is to explain what we can learn about the geometry of the moduli spaces from the gluing structure of the determinant line bundles.*

Nathan MCSTAY (University of Cambridge)

Title: Understanding the target space of string theory at large alpha

Abstract: *As a theory of quantum gravity, string theory is defined perturbatively around a fixed background metric. We quantify these perturbations to the metric using the inverse string tension, alpha'. We usually consider the supergravity limit of small alpha', yet it known to be possible to study beyond this regime when the background takes the form of a group manifold, such as AdS3. In this talk, I will discuss the interpretation of the target space geometry in the minimal tension limit of string theory on AdS3. We will find that the theory is most naturally*

Hadi NAHARI (Université Lyon 1- Université Paris 12)

Title: The minimal Lie groupoid and infinity algebroid of the octonionic Hopf singular foliation

Abstract: *We explore the leaf decomposition L of R^{16} induced by the octonionic Hopf construction, which has no known Lie group generating it. We describe the construction of a Lie groupoid, G, whose orbits coincide with L. Correspondingly, we examine the Lie algebroid E associated with G, highlighting its linear structure functions. The singular foliation it induces turns out to be maximal among all modules having L as their leaf decomposition. Furthermore, we extend E to a Lie 3-algebroid. This step enables us to identify a representative for the universal Lie infinity algebroid of the singular octonionic Hopf foliation. Through this step, we demonstrate that G and its associated Lie algebroid E maintain the minimal dimension within this framework. An important property of the octonionic Hopf fibration of R^{16} is that it cannot be induced as the orbits of a local isometric Lie group action. We improve this result and show that any singular foliation $\mathcal{F}$ with this leaf decomposition is not Hausdorff Morita equivalent to a singular foliation induced by a local isometric action. This talk is based on a work in progress with Thomas Strobl.*

David PRINZ (Max Planck Institute)

Title: Renormalization of Gauge Theories and Gravity

Abstract: *The renormalization of gauge theories and, eventually, gravity is one of the biggest current challenges in mathematical physics. In my research, I am approaching this topic via the renormalization framework of Connes and Kreimer: In this setup, subdivergences are organized using the coproduct of a Hopf algebra of Feynman graphs and the renormalized Feynman rules are then constructed through an algebraic Birkhoff decomposition in the respective character group. When applied to (generalized) gauge theories, the obstructions for gauge anomalies — the so-called Slavnov–Taylor identities — form a Hopf ideal therein, as was originally shown by van Suijlekom and then refined by myself. In this talk, I first give a short introduction to the Connes–Kreimer renormalization framework and then explain its application to (generalized) gauge theories: Specifically, I will first discuss the case of Quantum Yang–Mills theory and then explain how this setup can be generalized to (effective) Quantum General Relativity. More information thereon can be found in my dissertation and the articles it is based upon, cf. arXiv:2210.17510 [hep-th].*

Jakob ULMER (Université Sorbonne Paris Nord)

Title: On Open topological String Field Theory and the Loday-Quillen-Tsygan theorem

Abstract: *Given a proper CY A-infinity category C, a notion closely related to that of a 2d extended TQFT, I explain how the Loday-Quillen-Tsygan map fits into a commutative diagram of dg-BV algebras. The first two corners are built from the cyclic cohomology of C, respectively from a cyclic L-infinity algebra associated to C. The other two corners are of a more geometric nature, given by chains on the moduli space of Riemann surfaces with corners, free boundaries decorated by objects of C, respectively chains on the moduli space of metric graphs. I indicate how this generalizes an observation by Kontsevich producing cocycles on* M_g, n*. Further I compare this to the story of closed SFT developed by Costello, Caldararu-Tu, which led to the definition of categorical Gromov-Witten invariants for categories C as above that are also smooth.*