

String Theory Journal Club

General info

Journal clubs are on Tuesdays from 13 to 14 in Seminar Room 3 (building 1).

Feel free to suggest papers in the comments section. Note that you can also add attachments and comment on other people's suggestions.

Important: You need to login to see and add comments.

Winter semester 2019-2020

Journal club 07-04-2020

- Fabrizio Neri: [Physics and geometry of knots-quivers correspondence](#)

Journal club 09-03-2020

- Matteo Parisi, Amplituhedra: Scattering Amplitudes from Geometry

Abstract:

The Amplituhedra $A(n,k,m)$ are generalisations of polytopes introduced as a geometric construction encoding scattering amplitudes in planar $N=4$ supersymmetric Yang-Mills theory (SYM). These are extracted from a differential form, the canonical form of the Amplituhedron, which emerges from a purely geometric definition.

Following my recent works, I will explain how the Jeffrey-Kirwan residue, a powerful concept in symplectic and algebraic geometry, computes the canonical form for whole families of objects, namely for Amplituhedra of type $A(n,1,m)$, which are cyclic polytopes and for their conjugates $A(n,n-m-1,m)$ for even m , which are not polytopes.

This method connects to the rich combinatorial structure of triangulations of Amplituhedra, captured by what we refer to as 'Secondary Geometry'. For polygons, this is the 'Associahedron', explored by Stasheff in the sixties; for polytopes, it is the 'secondary polytope' constructed by the Gelfand's school in the nineties. Whereas, for Amplituhedra, we are the first to initiate the studies of what we called the 'Secondary Amplituhedra'. The latter encodes all representations of scattering amplitudes, many not obtainable with any physical method, together with their algebraic relations produced by global residue theorems.

Finally, I will briefly illustrate some of the recent geometric directions in my work on the Amplituhedron in momentum space and new exciting developments connecting the (secondary geometry of) $m=2$ amplituhedron with the positive tropical Grassmannian. This object has been appearing in dozens of papers in the physics community in the last year, both in bootstrapping loop amplitudes in planar $N=4$ SYM and in computing (a generalisation of) biadjoint scalar amplitudes.

Journal club 03-03-2020

- Lorenzo Quintavalle, Celestial Sphere Amplitudes

Abstract:

Over the recent years there has been many developments in the study of four-dimensional Quantum Field Theories through a CFT description on the Celestial sphere. The aim of this Journal club is to review the basic ideas behind Celestial sphere amplitudes. We will start from the discussion of asymptotic symmetries in electrodynamics, to then describe soft theorems taking the case of Scalar QED as an example. We will see how this suggests a 2D CFT interpretation, and therefore introduce the concept of Celestial sphere amplitudes.

Journal club 25-02-2020 (TBA)

Journal club 18-02-2020

- Madalena Lemos (CERN), Surface defects in 4d superconformal theories and chiral algebras (This seminar will take place in **Building 3 Seminar room BAH 2**)

Abstract:

We study symmetry constraints on BPS surface defects in four-dimensional superconformal field theories, showing how supersymmetry imposes relations on anomaly coefficients. Turning to dynamics, we analyze a protected subsector of $N=(2,2)$ surface defects that is captured by a two-dimensional chiral algebra. We discuss how to compute observables of interacting defects from the chiral algebra, including the aforementioned anomaly coefficients.

Journal club 11-02-2020 (Integrability school)

Journal club 04-02-2020

- Taro Kimura (Bourgogne U.), Yet another affinization of geometric Langlands correspondence

Abstract:

One of the implications of the geometric Langlands correspondence is the isomorphism between conformal blocks of W -algebra and affine Lie algebra. This correspondence has a natural q -deformation, providing a relation between q -deformation of W -algebra and quantum affine algebra. In this talk, I'll discuss yet another affinization of this correspondence between doubly affine W -algebra and quantum toroidal algebra, based on the formalism of quiver W -algebra. I'll also mention its possible physical interpretation in gauge theory with the surface defects.

Journal club 28-01-2020

- Federico Carta (DESY), Supersymmetry Enhancement

Journal club 21-01-2020

- Lorenzo Quintavalle (DESY), Celestial sphere amplitudes

Journal club 10-12-2019

- Fabrizio del Monte (SISSA), Class S theories and isomonodromic deformations on the torus.

Abstract:

In the last few years there have been many new results connecting (linear quiver) $N=2$ class S theories, and the topological strings that engineer them, to the theory of isomonodromic deformations on the sphere and their q -deformations. These gauge theories are constructed by compactifying the 6d $N=(0,2)$ SCFT on a punctured Riemann Sphere, whose moduli, which are the marginal deformations of the gauge theory, are the times of the isomonodromic flows. The aim of this talk is to show how this connection can be extended beyond the case of genus zero, for more general (asymptotically superconformal) class S theories. We will discuss in detail the case of circular quiver gauge theories, that are obtained from the $N=(0,2)$ SCFT on punctured tori, and see how the genus one case displays new qualitative features that are absent on the sphere, due to the possibility of various inequivalent vector bundles, and how this actually provides new interesting relations satisfied by the gauge theory partition function.

Journal club 03-12-2019

- Jack Foster (Southampton University): Cluster Adjacency, Tropical Geometry, and Scattering Amplitudes

Abstract: I will discuss two new areas of interest in scattering amplitudes: cluster adjacency and tropical geometry. The former describes how the analytic structure of planar amplitudes in $N=4$ Super Yang-Mills is controlled by mathematical objects called cluster algebras. The latter has been used to calculate amplitudes in the biadjoint ϕ^3 theory, which I will discuss briefly, but it also has implications for cluster adjacency.

Journal club 26-11-2019

- Francesco Galvano (Torino): Emitted radiation and geometry (This seminar will take place in **Building 3 Seminar room BAH 2**)

Abstract: We discuss the computation of the radiated energy by an accelerated heavy particle. This quantity is captured by the one-point function of the stress energy tensor in presence of a Wilson line. In a $N=2$ superconformal theory we prove that this observable is exactly related to a small geometric deformation of the background geometry. In a four dimensional case, supersymmetric localization allows to express the emitted energy in terms of a matrix model on a squashed sphere.

Journal club 19-11-2019

- No seminar scheduled.

Journal club 12-11-2019

- Zhengwen Liu: Scattering Equations and Multi-Regge Kinematics

Abstract: The scattering equations, a system of algebraic equations connecting the space of kinematic invariants and the moduli space of punctured Riemann spheres, provide a novel way to construct scattering amplitudes. In this framework, the tree-level S -matrix in many quantum field theories can be reformulated as a multiple integral that is entirely localized on the zeroes of the scattering equations. After presenting a very minimal introduction to the scattering equations, I will discuss the asymptotic behavior of the scattering equations in the so-called Multi-Regge kinematic regime and the corresponding factorizations of amplitudes in gauge theory and gravity.

References:

[Multi-Regge kinematics and the scattering equations](#)
[Gravitational Scattering in the High-Energy Limit](#)

Journal club 05-11-2019

- Yuta Sekiguchi (U. Bern, AEC), [O\(d,d\) transformations preserve classical integrability](#).

Abstract: We studied the classical integrability of $O(d,d)$ transformations including not only $O(d,d;Z)$ duality but also global $O(d,d;R)$ deformation. The latter is known in the traditional literature to generate so-called current-current ($J\bar{J}$) deformations of 2D CFTs. In this talk, I first plan to give brief reviews Yang-Baxter deformations of string backgrounds as well as the doubled sigma model. Then I will present how to construct the Lax pairs in the $O(d,d)$ deformed WZNW models via $O(d,d)$ map through very easy examples. The resulting Lax connections are in general non-local because they depend on the winding modes. Finally I will briefly comment on open questions under consideration in relation to the recent irrelevant integrable deformation. This talk is based on the recent work [1907.03759] with Domenico Orlando, Susanne Reffert and Kentaroh Yoshida.

Journal club 29-10-2019

- Till Bargheer: Exact Four-Point Functions: Genus Expansion and Strong Coupling (This seminar will take place in **Building 3 Seminar room BAH 2**)

Using integrability, correlation functions of local operators in planar $N=4$ super Yang-Mills theory can be computed by reconstructing the dual worldsheet from a set of "hexagon" patches via "gluing" (performing complete state sums over mirror Bethe states). After reviewing this general procedure, I will explain how it can be used to compute a certain class of four-point correlators as an exact function of the coupling at any order in the $1/N_c$ genus expansion, and how the resulting series can be re-summed (via a suitable matrix model) to recover the full N_c dependence. If time permits, I will also comment on the strong-coupling limit of these correlators.

Journal club 22-10-2019

- Gleb Kotousov: "Reflection operators in integrable QFT".

Journal club 15-10-2019

- Sylvain Lacroix, [Gauge Theory And Integrability, III](#) (focusing on the second part about "disorder defects").

Summer 2019

Journal club 08-10-2019

- Alessandro Pini, [Extremal Correlators and Random Matrix Theory](#).