Eurostrings 2023

24-28 April 2023
Gijón

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Invited speakers:

- Dionysios Anninos (Review talk)
- Agnese Bissi (Review talk)
- Márk Mezei (Review talk)
- Thomas Van Riet (Review talk)
- Shu-Heng Shao (Review talk)
- Tim Adamo
- Daniel Areán
- Ben Craps
- Laura Donnay
- Akash Jain
- Shota Komatsu
- Javier Magán
- Sameer Murthy
- Carlos Núñez
- Balt Van Rees
- Henning Samtleben
- Marija Tomašević
- Gabi Zafrir
- Michele del Zotto

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**Praise to the horizon,* Eduardo Chillida

Gijón Convention Bureau

Universidad de Oviedo — Universitat de Barcelona — ift Instituto de Física Teórica UAM-CSIC

Contents

1 Review talks

- **Dionysios Anninos - Aspects of de Sitter spacetimes**

  We review recent developments in the study of asymptotically de Sitter spaces. The developments concern both a more global, cosmological perspective, as well as that of the physics associated to a quasi-local observer surrounded by the cosmological event horizon. Euclidean gravity methods are also discussed.

- **Agnese Bissi - A CFT perspective on AdS amplitudes**

  In this talk I will review recent advancements on the use of the conformal bootstrap in the context of holographic CFTs to compute scattering amplitudes in the dual AdS spaces. I will describe how to systematically study the large N expansion of four point correlation functions to make contact with four point scattering amplitudes of gluons and gravitons. I will give an overview of the results obtained and conclude with future directions.

- **Mark Mezei - Defects and the renormalisation group**

  In recent years our understanding of defects in QFTs has advanced on multiple fronts. This review talk focuses on the study of defect renormalization group flows and fixed points. Specifically, we consider setups where the bulk QFT is conformal, but the defect (or boundary) is not. We provide an overview of general results and discuss several examples, where computations in a variety of perturbative expansions can be combined with general considerations to determine the phase diagrams of defects.

- **Thomas Van Riet - Swampland and flux vacua**

  In this attempt for a pedagogical review, I will discuss aspects of the Swampland program that deal with flux compactifications and in particular I focus on the sign and the size of vacuum energy and the role of extra dimensions.

- **Shu-Heng Shao - Non-invertible Symmetry**

  We will review some recent developments on a new kind of symmetry, the non-invertible symmetry. It is implemented by a conserved operator that does not have an inverse, going outside the paradigm set by Wigner's theorem. Non-invertible symmetries exist in many familiar quantum systems, ranging from the Ising model, to real-world QED and QCD, to axion physics, and to the low energy limit of string and M-theory. It has become evident that the proper mathematical language for symmetry in quantum field theory should be the category theory, not just the group theory.

2 Invited talks

- **Tim Adamo - Scattering in strong backgrounds and why you should care**

  Scattering amplitudes in strong background fields provide an arena where perturbative and non-perturbative physics meet, with important applications ranging from laser physics to black holes, but their study is hampered by the cumbersome nature of QFT in the background field formalism. In this talk, I will try to convince you that strong-field scattering amplitudes contain a wealth of physical information which cannot be obtained with standard perturbative techniques, ranging from all-order classical observables to constraints on exact solutions. Furthermore, I will discuss how amplitudes in certain chiral strong fields can be obtained using methods from string theory and twistor theory.

- **Daniel Arean - Non-Hermitian Holography**

  The formulation and study of non-Hermitian PT-symmetric quantum theories has been the focus of both theoretical and experimental activity in recent years. In this talk I will present a minimal gravity dual of a non-Hermitian QFT, discuss its main features, and present novel solutions corresponding to a spatially modulated non-Hermitian deformation.

- **Ben Craps - Definitions of entwinement**

  Entwinement was first introduced as the CFT dual to extremal, non-minimal geodesics of quotiented AdS3 spaces. It was heuristically meant to capture the entanglement of internal, gauged degrees of freedom, for instance in the symmetric product orbifold CFT of the D1/D5 brane system. The literature now contains different, and sometimes inequivalent, field theory definitions of entwinement. We build a discretized lattice model of symmetric product orbifold CFTs, and explicitly construct a gauge-invariant reduced density matrix whose von Neumann entropy agrees with the holographic computation of entwinement. Refining earlier notions, our construction gives meaning to the entwinement of an interval of given size within a long string of specific length. We discuss similarities and differences with previous definitions of entwinement.

- **Laura Donnay - A Carrollian perspective on celestial holography**

  I will present some aspects of a Carrollian approach to holography in asymptotically flat spacetimes, where the dual theory lives on a lightlike co-dimension one boundary. I will also discuss its interplay with celestial holography and celestial 2d CFTs.

- **Akash Jain - Higher-form symmetries and topological phase transitions**

  Symmetries and their breaking patterns are a valuable tool in physics for classifying and describing phases of matter. In recent years, a new generalised notion of symmetries has emerged, dubbed "higher-form symmetries", where the associated conserved charges are carried by higher-dimensional objects like strings and surfaces, instead of the usual point-like particles. In this talk, I will give a brief overview of higher-form symmetries and their spontaneous and explicit breaking patterns. In particular, the explicit breaking of higher-form symmetries is associated with the emergence of topological defects in many-body systems. I will outline a new hydrodynamic framework for systems with (approximate) higher-form symmetries and use this to study transitions between topological phases of matter. This includes the melting phase transition in smectic crystals, the plasma phase transition from polarised gases to magnetohydrodynamics, the superfluid to neutral fluid phase transition, and the Meissner effect in superconductors, among many others. The talk will be based on: https://arxiv.org/abs/2301.09628.

- **Shota Komatsu - String Duals of Two-Dimensional Yang-Mills and Symmetric Product Orbifolds**

  We propose candidate worldsheet descriptions of large N two-dimensional Yang-Mills and symmetric product orbifold CFT for arbitrary seed CFTs.

- **Javier Magan - Microscopic origin of the entropy of black holes**

  We construct an infinite family of geometric black hole microstates, both in Anti de Sitter and Minkowski spacetimes. This family of microstates naively overcounts the Bekenstein-Hawking entropy. Quantum mechanical wormholes cause these microstates to have exponentially small, but universal, overlaps. We show how these overlaps imply that the microstates span a Hilbert space of log dimension equal to Bekenstein-Hawking entropy.

- **Sameer Murthy-The quantum entropy of extremal black holes and the Schwarzian theory**

  I will revisit the quantum entropy of extremal black holes which is defined as a path integral in the near-horizon AdS2 region. This has been studied in the past using different methods: loop calculations give rise to leading logarithmic corrections to the area law, and localization gives rise to a sum over all perturbative corrections. The new development has to do with the exact treatment of the zero-modes that appear in the near-horizon region, which can be described by the Schwarzian action at small temperatures. I will show how this allows us to (1) calculate the non-perturbative effects in the localization calculation, so as to get integer degeneracies out of gravity, and (2) control the zero-temperature limit properly for extremal (not necessarily supersymmetric) black holes, leading to new logarithmic effects.

- **Carlos Núñez - Aspects of gauge-strings duality: SCFTs in diverse dimensions**

  In this talk, I discuss some aspects of SCFTs with eight supercharges in dimensions 3,4,5,6. I try to elaborate on how Holography "sees" some common aspects of these theories. To conclude, I comment on RG-flow away from the conformal points.

- **Balt Van Rees - QFT in AdS and the flat-space limit**

  The natural boundary correlation functions for a QFT in a fixed AdS background are conformally covariant and can therefore be studied with conformal bootstrap methods. We will discuss how this leads to constraints on RG flows between different QFTs. Furthermore, the flat-space limit of these correlation functions allows one to derive general properties of non-perturbative scattering amplitudes.

- **Henning Samtleben - Consistent truncations, Kaluza-Klein spectroscopy, and beyond**

  I review new tools from exceptional field theory for the computation of Kaluza-Klein spectra around various background geometries. Applications include squashed spheres and non-supersymmetric AdS vacua which are perturbatively stable at all Kaluza-Klein levels. The techniques can be extended in order to compute the cubic and higher-order couplings for the entire infinite Kaluza-Klein towers.

- **Marija Tomasevic - The correspondence principle between rotating black holes and fundamental strings**

  The correspondence principle is an old idea pioneered by Susskind, and Horowitz and Polchinski in the late 90s. The idea is to relate a black hole to a set of weakly coupled states, providing a statistical description of a black hole. In this talk, I will formulate the correspondence between a wide variety of rotating black holes in arbitrary dimensions, and strings with angular momentum. Adding rotation emphasizes the importance of accounting for dynamical transitions, which were not considered before.

- **Gabi Zafrir - On the compactification of 5d SCFTs to 3d and discrete anomalies**

  Much insight into the dynamics of field theories can be gained by studying the relationship between field theories in different dimensions. An interesting observation is that when two theories are related by dimensional reduction, then their 't Hooft anomalies in continuous symmetries are also related. This raises the question if a similar relation also holds for the case of anomalies in discrete symmetries. In this talk, we shall explore this idea in the context of compactification of five dimensional superconformal field theories (SCFTs) to three dimensions. We shall discuss how this can be used in the study of anomalies and dimensional reduction of field theories.

- **Michele del Zotto - The Higher Structure of Chiral Symmetry**

  In this talk we discuss the higher structure of symmetries of QFTs. As a running example we will exploit chiral symmetry in four-dimensions, that develops a higher structure in presence of ABJ anomalies, but our remarks will be more general. How can one detect the higher structure of a symmetry, if any? Are there consequences of the higher structure on correlators? In this talk we will present some answers to these questions that have been obtained in a joint collaboration with Christian Copetti, Kantaro Ohmori, and Yifan Wang.

3 Contributed talks

1. **Pablo Bueno - Generalized Symmetries for Generalized Gravitons**

   I will present new results involving the generalized symmetries of diffeomorphism-invariant theories of linearized gravity in arbitrary dimensions. Such theories descend from the Einstein-Hilbert action plus terms of quadratic order in the Riemann tensor, which introduce additional massive modes in the spectrum. First-principle considerations in quantum field theory force generalized symmetries to appear in dual pairs. I will argue that verifying this prediction leads, on the one hand, to new sets of non-trivial conserved charges —associated to 2-form and $(D-2)$-form currents— and, on the other, to unravel some naive charges which do not generate actual symmetries. Both for Einstein gravity and for its quadratic modifications, the number of conserved charges is equal to $D(D+1)$ and, in each case, they can be used to fully specify the theory.

2. **Pablo A. Cano - The extremal Kerr entropy in higher-derivative gravities**

   We investigate higher derivative corrections to the extremal Kerr black hole in the context of heterotic string theory and of a cubic-curvature extension of general relativity. By analyzing the near-horizon extremal geometry of these black holes, we are able to compute the Iyer- Wald entropy as well as the angular momentum via generalized Komar integrals. In the case of the stringy corrections, we obtain the physically relevant relation S(J) at order alpha'^{2}. On the other hand, the cubic theories we study possess special integrability properties that enable us to obtain exact results in the higher-derivative couplings. This allows us to find the relation S(J) at arbitrary orders in the couplings and even to study it in a non-perturbative way. We also extend our analysis to the case of the extremal Kerr-(A)dS black hole.

3. **Gabriel Cardoso - The gravitational path integral for N=4 BPS black holes from black hole microstate counting**

   The degeneracies of 1/4 BPS black holes in four-dimensional D=4 heterotic string theory are given in terms of the Fourier coefficients of the meromorphic Siegel modular form $1/\Phi_{10}$. In the first part of this talk, we show how to obtain an exact expression for these degeneracies by using the symplectic symmetries of $1/\Phi_{10}$ to construct a fine-grained Rademacher type expansion which expresses these BPS degeneracies as a regularized sum over residues of the poles of $1/\Phi_{10}$. In the second part of the talk, we use the exact expression for the microscopic degeneracies of these single-centre black holes to improve on the existing formulation of the corresponding quantum entropy function obtained using supersymmetric localization. The result takes the form of a sum over Euclidean backgrounds including freely acting orbifolds of the Euclidean $AdS_2 \times S^2$ attractor geometry. We further show how a rewriting of the degeneracy formula is amenable, at a semi-classical level, to a gravitational interpretation involving 2D supersymmetric wormholes. This alternative picture is useful to elucidate different aspects of the gravitational path integral capturing the microstate degeneracies. We also comment on the relation between the corresponding 1D holographic models.

4. **Christopher Couzens - The Holographic duals of Argyres-Douglas theories**

   Argyres-Douglas (AD) theories are 4d N=2 SCFTs which have some unusual features, and until recently, explicit holographic duals of these theories were unknown. We will consider a concrete class of these theories obtained by wrapping the 6d N=(2,0) ADE theories on a (twice) punctured sphere: one irregular and one regular puncture, and construct their holographic duals. The novel aspects of these solutions require a relaxation of the regularity conditions of the usual GaiottoMaldacena framework and to allow for brane singularities.

We show how to construct the dictionary between the AdS(5) solutions and the field theory and match observables between the two.

5. **Sibylle Driezen - Jordanian deformations of the AdS5 x S5 superstring**

   I will review recent work on integrable deformations of string sigma-models focusing on the so-called Homogeneous Yang-Baxter deformations. These are a class of deformations that can be understood as generalisations of the well-known TsT transformations. Many of the attractive features of TsT carry over to the Yang-Baxter class, from the possibility of generating new supergravity solutions to the preservation of worldsheet integrability. We can in particular exploit the fact that, as for TsT, the deformed sigma-model is equivalent on-shell to an undeformed model with twisted boundary conditions. For the Jordanian sub-class, this twist is diagonalisable. This feature will make it particularly efficient to employ integrable methods such as the classical spectral curve and its semi-classical quantisation to obtain energy corrections, and thus opens a route to study integrable deformations of AdS/CFT. I will report on progress obtained for a particular Jordanian deformation of the AdS5 x S5 superstring along with a classification of all possible Jordanian deformations enjoying different properties with a wide range of possible applications.

6. **Jerome Gauntlett - Entropy functions for AdS black holes**

   The talk would summarise recent work that illuminates our understanding of black hole entropy for supersymmetric black holes in Anti-de-Sitter space. In more detail: we consider supersymmetric $AdS_3 \times Y_7$ solutions of type IIB and $AdS_2 \times Y_9$ solutions of $D = 11$ supergravity. These can arise as the near horizon limit of black strings in AdS_5 and and black holes in AdS_4 spacetimes, respectively. We explain how novel extremisation techniques enable one to compute physical observables without explicitly solving Einstein equations. This allows one to identify infinite new classes of AdS_3/d=2 SCFT pairs, as well obtain a microstate counting interpretation for infinite classes of supersymmetric black holes in AdS_4. A sub-class of examples correspond to branes wrapping certain two-dimensional orbifolds known as spindles and this has opened up a new direction in AdS/CFT with novel connections to accelerating black holes.

7. **Umut Gursoy - Worldsheet from Worldline**

   Gauge-gravity duality plays a key role in understanding quantum gravity and strongly interacting gauge theories, however, lacks a satisfactory microscopic derivation. Fundamental questions such as, how does gravity emerge directly from quantum field theory observables and how to determine which QFTs are holographic, which are not, remain unanswered. In this talk, I propose a primitive form of gauge-string duality based on the worldline formulation of perturbative QFT. In particular we consider L loop quantum corrections to correlation functions in an holographic QFT where a Schwinger parameter is associated to each internal propagator in the corresponding Feynman diagrams. We argue that embedding of the holographic coordinate in string theory emerges from the collection of these Schwinger parameters in the continuum limit of the Feynman diagrams. As a by product, we provide a novel Kallen-Lehmann representation of two-point functions as a sum over boundary-to-boundary propagators of massive bulk scalars in AdSd+1 with masses determined by L. This novel approach can be generalized to arbitrary N. Therefore it might have two potential uses: to provide i) a non-perturbative approach to quantum gravity in terms of perturbative QFT at finite N, ii) a true bottom-up holographic construction for confining gauge theories like QCD derived directly from QCD amplitudes.

8. **Tobias Hansen - Bootstrapping the AdS Virasoro-Shapiro amplitude**

   The Virasoro-Shapiro amplitude on AdS5xS5 is the full tree-level string amplitude of four gravitons on AdS5xS5, or the four-point correlator of the stress-energy tensor in planar N=4 SYM including all order corrections in $1/\lambda$. In this talk I will explain how this correlator can be determined using considerations similar to the ones that led to the discovery of the Veneziano amplitude. Boundedness in the Regge limit follows from the bound on chaos and lets us derive dispersive sum rules that relate the Wilson coefficients from the low energy effective action with the OPE data of short massive operators in N=4 SYM theory at strong coupling. The assumption that the Wilson coefficients are in the ring of single-valued multiple zeta values, as expected for closed string amplitudes, is surprisingly powerful and leads to a unique solution to the sum rules for the $1/\sqrt{\lambda}$ correction. The corresponding OPE data fully agrees with and extends the results from integrability. The Wilson coefficients can be summed, giving the full crossing-symmetric, Regge bounded $1/\sqrt{\lambda}$ correction to the flat space Virasoro-Shapiro amplitude. The talk is based on 2204.07542, 2209.06223 and WIP.

9. **Alberto Lerda - Strong coupling results in N=2 gauge theories**

   We discuss recent developments in the study of correlation functions for a large class of four dimensional gauge theories with N=2 supersymmetry. In the planar limit we are able to find exact compact expressions that are valid for all values of the coupling constant and hence to derive the strong-coupling expansions in an analytic way. At leading order we obtain the same results also from the holographic dual using the AdS/CFT correspondence at the supergravity level. This agreement confirms the validity of the analytic strong-coupling results and of the holographic correspondence in a non-maximally supersymmetric setup. Based on: 2206.13582 hep-th; 2207.08846 hep-th; 2211.11795 hep-th

10. **Horatiu Nastase - ttbar deformations and the pp-wave correspondence**

    $T\bar{T}$ deformations were defined for 2 dimensional theories and preserve integrability. In higher dimensions, there are several proposals for its extension. In holography, one can define either the deformations of the boundary condition or, for single-trace deformations, the deformation of an AdS_3 bulk theory. Penrose limits can be used to better understand dual pairs that are less defined. I describe a proposal to extend the AdS_3 single-trace deformation, more specifically for its Penrose limit, to the $AdS_5 \times S^5$ vs. N=4 SYM case. I also define deformations of the pp wave correspondence through the worldsheet string on the pp wave, and find the corresponding spin chain deformation in N=4 SYM.

11. **Kevin Nguyen - Virasoro blocks and reparametrization formalism**

    An effective theory designed to compute Virasoro identity blocks at large central charge, expressed in terms of the propagation of a reparametrization/shadow mode between bilocal vertices, was recently put forward. In this talk I provide the formal theoretical framework underlying this effective theory by reformulating it in terms of standard concepts: conformal geometry, generating functionals and Feynman diagrams. This sheds light on the reason of existence for this effective theory but also points towards some of its limitations.

12. **Juan F. Pedraza - Lorentzian hyperthreads and nonlocal computation in holography**

    The connected wedge theorem and its generalizations imply that gravitational systems with holographic duals perform nonlocal quantum computation protocols. We examine the extent to which current proposals for holographic computational complexity support this claim, focusing on CV duality. While the reformulation of CV duality in terms of Lorentzian threads suggests that computation is implemented with local gates, we find that the original formalism is insufficient when it comes to analyzing the complexity of subsystems and their inequalities. In particular, we show that standard Lorentzian threads cannot account for the negativity of mutual complexity in multipartite systems. To address this issue, we modify the original program by introducing multiple flavors of threads. Our analysis reveals that an optimal solution of this new program implies the existence of additional types of gates that enable nonlocal computation. By analogy with the Riemannian case, we refer to these new microscopic building blocks as Lorentzian 'hyperthreads'.

13. **Nicolo Petri - Action metrics on AdS string vacua**

    The AdS Distance Conjecture proposes to assign a notion of distance between AdS solutions of string theory. The proposed distance receives a contribution from variations of the AdS conformal factor, which is negative. It is not clear how to make sense of a negative distance, and indeed this negativity is related to the famous conformal factor problem of quantum gravity. In my talk I will introduce the notion of action metric as a first proposal for a consistent notion of metric over the space of AdS vacua in string theory (with or without scale separation). As it is well-known, within families of AdS solutions in string theory, it is not possible to vary only the AdS conformal factor, but simultaneously also the geometry of the internal dimensions, as well as various fluxes and fields, must be varied. In my talk I will explain how to take into account the simultaneous variation of all these terms in the action metric and I will discuss its explicit derivation for the simplest one-parameter solutions in M-theory, the Freund-Rubin vacua in eleven-dimensional supergravity AdS4xS7 and AdS7xS4.

14. **Himanshu Raj - Exact large charge in N=4 SYM and semiclassical String Theory**

    Using the S-duality invariance of N=4 Yang-Mills theory with gauge group SU(n) and supersymmetric localization we find a solution for a family of integrated four-point correlation functions indexed by R-charge p which is exact in all parameters: complexified gauge coupling tau, rank n and the R-charge p. Such a result takes the form of an semi-infinite couple harmonic oscillator. We use our exact formulae to derive novel results for the large R-charge expansion. A non-trivial t Hooft-like double scaling limit (previously found in the study of extremal correlators in N=2 SQCD) is seen to hold. We analyze the non-perturbative terms both in large charge expansion at finite gauge coupling and the strong t Hooft coupling limit. The scale of non-perturbative correction is found to be given by masses of BPS dyons. Furthermore, a new calculable triple-scaling limit is analyzed where p scales like n^2. In this regime, we study the scale of non-perturbative corrections which provides an unusual window into a large charge regime of semiclassical type IIB string theory expanded around its AdS x S5 vacuum.

15. **Alejandro Ruipérez - Corrections to AdS_5 black hole thermodynamics from higher derivative supergravity**

    I shall present the results that have recently appeared in 2208.01007 hep-th, where we study four-derivative corrections to five-dimensional minimal gauged supergravity and evaluate the on-shell action of the AdS(5) black hole solution with two independent angular momenta and one electric charge at linear order in the corrections. After imposing supersymmetry, we are able to recast the action in terms of the supersymmetric chemical potentials and match the result obtained from the dual superconformal index on the second sheet. We then use the on-shell action to determine the corrections to the black hole thermodynamics, including those to the entropy and the charges. We then specialize to the supersymmetric and extremal case and find a simple expression for the microcanonical entropy. In particular, for the case with one independent angular momentum the corrections are entirely encoded in the dual superconformal anomaly coefficients. We corroborate our results for the black hole entropy constructing the corrected near-horizon solution and applying Wald's formula and also evaluating the Legendre transform of the supersymmetric on-shell action.

16. **Lorenz Schlechter - The Tameness of QFT and CFT**

In this presentation, I will discuss tameness as a finiteness principle that can be applied to a variety of physical systems. Specifically, I will introduce the concept of tame geometry and explore its application to both perturbative and non-perturbative quantum field theories (QFTs). Through an examination of solvable models, I will gather evidence to support tameness as a swampland criterion, and put forth precise conjectures regarding the tameness of amplitudes, as well as the space of QFTs and CFTs.

17. **Ritam Sinha - RG flows on 2-dimensional spherical defects**

    We consider RG flows on two-dimensional spherical defects embedded in d-dimensional Conformal Field Theories. I will argue that such an RG flow admits the existence of a decreasing entropy function which, at the fixed points of the flow, assumes the value of the anomaly coefficient which multiplies the Euler density in the defect's Weyl anomaly. Our construction demonstrates an alternative derivation of the irreversibility of RG flows on two-dimensional defects. Moreover, in the case of perturbative RG flows, the entropy function decreases monotonically and plays the role of a C-function. I will end with a discussion on generalising the construction for higher dimensional defects.

18. **Stefan Vandoren - Freely acting orbifolds of type IIB string theory on T5**

    We study freely acting orbifolds of type IIB string theory on T^5 that spontaneously break supersymmetry from N=8 to N=6,4,2 or 0 in five dimensions. We focus on orbifolds that are a quotient by a T-duality acting on T^4 and a shift on the remaining S1. Modular invariant partition functions are constructed and detailed examples of both symmetric and asymmetric orbifolds are presented, including new examples of five-dimensional non-supersymmetric string theories with no tachyons. The orbifolds we consider arise at special points in the moduli space of string theory compactifications with a duality twist. The supergravity limit of these are Scherk-Schwarz reductions which generate gauged supergravities with positive definite potentials on the moduli space in five dimensions. Both symmetric and asymmetric freely acting orbifolds give a landscape of Minkowski vacua. For gauged supergravities to belong to this landscape, we find a number of constraints and conditions. Firstly, the scalar potential should lead to a massive spectrum with masses that obey quantization conditions arising from a string theory orbifold, which we discuss in detail. Secondly, we find constraints on the massless sector, e.g. in the examples of orbifolds preserving sixteen supercharges in five dimensions that we consider, only an odd number of vector multiplets arise. Lastly, we present new examples of candidate asymmetric orbifolds with modular invariant partition functions, but with non-integral coefficients in the qq$^-$-expansion in the twisted sector.

19. **Sebastian Waeber - Scaling in holographic turbulence**

    We present work in progress towards an improved understanding of turbulent fluid dynamics through holography and the fluid/gravity correspondence. By identifying covariant quantities in the dual gravity theory that correspond to correlators of the fluid velocity in the boundary field theory and their higher moments, the statistical properties of turbulent flow can be fully geometrized. We numerically confirm these relations in a setting where we consider the fluid phase of conformal matter driven by a randomly fluctuating background metric, computed in the dual gravity theory by solving the evolution of a black hole in four dimensional Anti-de Sitter space driven out of equilibrium by a stochastically fluctuating boundary metric. We also comment on subtleties regarding the non-relativistic limit of conformal hydrodynamics.

4 Gong show

1. **Jose Calderón-Infante - Conserved Currents at Infinite Distance in the Conformal Manifold**

   The first part of the CFT Distance Conjecture posits that all points in which there is a higher-spin (HS) symmetry enhancement are at infinite distance in the conformal manifold with respect to the Zadmolodchikov metric. In this talk, I will discuss how to prove this conjecture using conformal perturbation theory and weakly-broken HS symmetry. Only assumptions of the conjecture are used, namely having a CFT in more than two dimensions with a conformal manifold and the presence of a local stress-energy tensor. For instance, no supersymmetry is required. If time permits, I will also discuss the case of flavor enhancement in the conformal manifold.

2. **Marine De Clerck - Bounds on quantum evolution complexity via lattice cryptography**

   In arXiv:2202.13924, we addressed the difference between integrable and chaotic motion in quantum theory as manifested by the complexity of the corresponding evolution operators. Complexity is understood here as the shortest geodesic distance between the time-dependent evolution operator and the origin within the group of unitaries. (An appropriate 'complexity metric' must be used that takes into account the relative difficulty of performing 'nonlocal' operations that act on many degrees of freedom at once.) While simply formulated and geometrically attractive, this notion of complexity is numerically intractable save for toy models with Hilbert spaces of very low dimensions. To bypass this difficulty, we trade the exact definition in terms of geodesics for an upper bound on complexity, obtained by minimizing the distance over an explicitly prescribed infinite set of curves, rather than over all possible curves. Identifying this upper bound turns out equivalent to the closest vector problem (CVP) previously studied in integer optimization theory, in particular, in relation to lattice-based cryptography. Effective approximate algorithms are hence provided by the existing mathematical considerations, and they can be utilized in our analysis of the upper bounds on quantum evolution complexity. The resulting algorithmically implemented complexity bound systematically assigns lower values to integrable than to chaotic systems, as we demonstrate by explicit numerical work for Hilbert spaces of dimensions up to 10^4.

3. **Thibaut Coudarchet - Symmetric fluxes and minimal tadpoles**

   Type IIB moduli stabilization in the axio-dilaton and complex structure sector becomes challenging as the number of scalar fields increases. In this talk, we will be interested in the Large Complex Structure (LCS) vacuum equations obtained from a specific orbifold mirror geometry with $h^{1,1} = 51$. The topological data available in the litterature for this Calabi-Yau allows us to build the polynomial contributions to the LCS prepotential and derive explicitly the vacuum equations. In a specific flux family setup, called "IIB1 scenario", where the superpotential is quadratic (cf talk by Mikel Alvarez), the system nicely splits into a very simple linear piece involving only the axions and a non-linear part involving the saxions. This structure enables us to define a procedure to efficiently generate consistent vacua, with a controlled flux-induced tadpole, at LCS. In practice, thanks to symmetries among the triple intersection numbers, one can further assume a symmetric ansatz with repeated entries for the saxions and the flux quanta, to effectively reduce the saxionic system down to only two or four parameters. The combination of the IIB1 setup and the symmetric ansatze is thus a way to formulate moduli stabilization in terms of a system of 2 or 4 equations instead of 104, which then becomes accessible numerically. We will examine some solutions at LCS that stabilize all (or almost all) moduli and disucss how they relate to the Tadpole Conjecture.

4. **Marina David - T-duality building blocks in stringy corrections**

T-duality has been shown to constrain the higher derivative corrections of string theory. We revisit the problem of understanding the T-duality constraints imposed on the alpha prime corrections using the language of a torsionful connection to construct O(d,d) invariant building blocks for general d-dimensional torus compactifications. This also suggests that there are in fact some hidden geometrical structures in string theory and use this to revisit the heterotic and bosonic ten-dimensional string action at order alpha prime.

5. **Bernardo Fraiman - Unifying the 6D N = (1, 1) String Landscape**

   We propose an organizing principle for string theory moduli spaces in six dimensions with N = (1, 1), based on a rank reduction map, into which all known constructions fit. In the case of cyclic orbifolds we make an explicit connection with meromorphic 2D (s)CFTs with c = 24 (c = 12) and show how these encode every possible gauge symmetry enhancement in their associated 6D theories. These results generalize naturally to non-cyclic orbifolds, into which the only known string construction (to our awareness) also fits. This framework suggests the existence of a total of 47 moduli spaces: the Narain moduli space, 23 of cyclic orbifold type and 23 of non-cyclic type. Of these only 17 have known string constructions. Among the 30 new moduli spaces, 15 correspond to pure supergravity, for a total of 16 such spaces. A full classification of nonabelian gauge symmetries is given, and as a byproduct we complete the one for seven dimensions, in which only those of theories with heterotic descriptions were known exhaustively.

6. **Daniele Gregori - Black holes' quasinormal modes from N=2 gauge theory and integrability**

   Recently a very surprising, interesting and useful connexion has been found among black hole physics, quantum integrable systems and N=2 supersymmetric gauge theory. The physical origin of this interrelation is yet to be understood, but mathematically it is possible because all three theories are completely described, in a disguised different way, by the solutions of some ordinary differential equation (ODE) which is shared by all three theories. We worked in particular from the integrability side and analysed the ODEs through a method which connects them to integrable models (IMs) (called ODE/IM correspondence), allowing thus exact control on their solutions. We first proved an identification among the basic physical quantities of all three theories (quasinormal modes, Q functions, gauge periods) and then derived its consequences, obtaining thus a fruitful flow of concepts, relations and tools from each theory to the others. Besides being interesting and suggestive in itself, this connexion is also useful because it allows to derive new results for all three theories, even at the exact non-perturbative level, which probably could not be obtained otherwise. Remarkably, on the black holes physics side the models involved are very physical and could connect also to astrophysical observations of newly discovered gravitational waves from black holes merging events. For example we found a completely new way to characterise and compute the quasinormal modes, that is the characteristic frequencies of the damped oscillations of spacetime immediately after a black hole merging, through a non-linear integral equation from integrability theory (Thermodynamic Bethe Ansatz), which shows certain advantages over other standard methods.

7. **Sabine Harribey - Cubic vector model on the boundary**

   We study a O(N) model with cubic interactions on a d-dimensional boundary with quartic interactions in the (d+1)-dimensional bulk. The presence of the quartic interactions in the bulk modifies the renormalization group analysis of the cubic boundary couplings. We compute beta functions and fixed points in a d=3-epsilon expansion up to two loops. We show the existence of a critical N above which only imaginary fixed points exist. In the large N limit, we show the existence of a stable purely imaginary fixed point. We compute the dimension of the phi^2 operators and find them to be real at this fixed point. The next goal would be to use these results to describe minimal models in two dimensions.

8. **Robie Hennigar - New Inequalities in Extended Black Hole Thermodynamics**

   Extended thermodynamics is the study of pressure and volume terms in the first law of black hole mechanics. In this context, the thermodynamic volume and horizon area have been conjectured to satisfy a ?reverse? isoperimetric inequality, which implies that, at a fixed volume, the Schwarzschild-AdS black hole maximizes entropy. In this talk, I will discuss recent work generalizing this inequality. In particular, I will argue that stronger variants of the reverse isoperimetric inequality hold for black holes with angular momentum, suggesting a hierarchy of new thermodynamic inequalities for black holes with conserved charges.

9. **Junho Hong - Superconformal Index, Holography, and Black Holes**

   In this talk, I will present the superconformal index of the ABJM/ADHM theories as a function of the magnetic fluxes and complexified electric chemical potentials valid to all orders in the large N expansion, focusing on the first two leading terms in the Cardy-like expansion. These results provide a way to explore the dual Euclidean M-theory path integral and count the microstates associated with the entropy of a dual supersymmetric Kerr-Newman AdS4 black hole beyond the semi-classical limit. I will also briefly comment on the generalization to other N=2 superconformal field theories.

10. **Max Hübner - The branes behind duality defects**

    Branes wrapped on cycles at infinity in a string theory construction give generalized symmetry operators in the engineered field theory. We briefly review this construction and consider it more closely in the context of field theories engineered via D3-brane probes of Calabi-Yau threefolds. In this setting we argue that 7-branes wrapped on the boundary of the Calabi-Yau construct duality defects for the D3 world volume theory. This generalizes non-invertible symmetries known from field theory constructions which in turn are of Kramers-Wannier type and constructed via half-space gauging.

11. **Francesco Mignosa: Non-supersymmetric fixed points in 5d and branewebs**

    Supersymmetric gauge theories in five dimensions, although power counting non-renormalizable, are known to be in some cases UV completed by a superconformal field theory. Many tools, such as M-theory compactification and pq-web constructions, were used in recent years in order to deepen our understanding of these theories. This framework gives us a concrete way in which we can try to search for additional conformal field theory via deformations of these well-known superconformal fixed points. A supersymmetry breaking mass deformation of the E1 theory which, at weak gauge coupling, was found to lead to pure SU(2) Yang-Mills, at strong coupling induces an instability on the Higgs branch, leading to a phase transition at finite coupling among the Yang-Mills phase and a phase where the global symmetry is spontaneously broken. During this talk, I will provide an explicit geometric construction of the deformation using brane-web techniques and I will generalize the analysis to a full class of SCFT, known as X1,N. The study of the large N limit of these theories unveils, in a specific regime, the existence of a second order phase transition, supporting evidence for the existence of non-supersymmetric fixed points in 5d. Based on 2109.02662 and2207.11162 with M. Bertolini and J. van Muiden.

12. **Angel Murcia - Universal aspects of holographic quantum critical transport with self-duality**

    We prove several universal properties of charge transport that hold for every CFT holographically dual to a four-dimensional theory of gravity non-minimally coupled to a gauge vector field in a duality-invariant way. First, we show that the product of the transverse and longitudinal self-energies is a universal constant for all frequencies and momenta, independent of the CFT under study. Secondly, we demonstrate that the conductivity at zero momentum is the same frequency-independent constant for all holographic duality-invariant theories. Thirdly, we prove that the conductivities at any frequency and momentum are independent of the duality-invariant theory as long as a General Relativity gravitational background is considered. For more generic gravitational configurations, we observe that the conductivities get modified for non-zero momentum. We find that these corrections are dominated by the particular gravitational background chosen, the effects associated to the specific choice of duality-invariant theory being subleading. We corroborate this last feature with an explicit example. The seminar is based on work in progress, which is intended to be on arXiv before the beginning of the Conference.

13. **Anayeli Ramírez - AdS3 solutions and holography**

    The AdS3/CFT2 correspondence provides the best arena to test the holographic duality. This is because there is a better understanding of how to quantise strings on AdS3, compared with the higher dimensional cases, and the relative tractability of two-dimensional CFTs. In spite of this, little effort has been made to construct and classify supersymmetric AdS3 solutions. By making use of G-structures techniques, I will discuss AdS3 solutions to massive IIA realising a superconformal algebra osp(n—2) for n=5,6 and also an AdS3 class in massive IIA preserving small N=(4,0) supersymmetry, for which there is a concrete proposal for the dual CFT.

14. **Ronnie Rodgers - Cosmic Strings and Celestial Entanglement**

    Celestial holography is a proposed duality between gravity in four-dimensional Minkowski space and a two-dimensional conformal field theory (CFT). I will argue that a class of singular superrotations which introduce a cosmic string into Minkowski space is dual to the uniformisation map used to compute the entanglement entropy of an interval in two-dimensional CFT. I will show that, with some mild assumptions, this allows the single-interval entanglement entropy in the celestial CFT to be obtained from a calculation in Minkowski space.

15. **David Rodríguez Fernández - T-linear resistivity, optical conductivity and Planckian transport**

    High temperature cuprate strange metals are noted for a DC-resistivity that scales linearly with TT from the onset of superconductivity to the crystal melting temperature, indicative of a Planckian dissipation life time. At the same time, the optical conductivity ceases to be of the Drude form at high temperatures, suggesting a change in dynamics that surprisingly leaves the TT-linear DC-resistivity unaffected. We use the AdS/CFT correspondence that describes strongly coupled, densely entangled states of matter to study the DC and optical conductivities of the local quantum critical Gubser-Rocha holographic strange metal in 2+1D in the presence of a lattice potential, a prime candidate to compare with experiment. We find that the DC-resistivity is linear in TT at low temperatures for a range of potential strengths and wavevectors, even as it transitions between different dissipative regimes. At weak lattice potential the optical conductivity evolves with temperature from a Drude form to a bad metal characterized by a mid-IR resonance without changing the DC transport, similar to that seen in cuprate strange metals. This mid-IR peak can be understood as a consequence of Umklapp hydrodynamics: i.e. hydrodynamic perturbations are Bloch modes in the presence of a lattice. At strong lattice potential an incoherent metal is realized where momentum conservation no longer plays a role in transport. In this regime the thermal diffusivity appears insensitive to the breaking of translations and can be explained by Planckian dissipation originating in universal microscopic chaos. The charge diffusivity cannot be explained this way, though the continuing linear-in-T DC resistivity saturates to an apparent universal slope, numerically equal to a Planckian rate. We conjecture that this may originate in chaos properties that differ between charged and neutral operators.

16. **Mikel Sanchez Garitaonandia - Gravitational waves from first order phase transitions**

    First order phase transitions in the early universe are known to induce out-of-equilibrium physics that sources potentially observable gravitational waves by next generation experiments. These are assumed to proceed via the nucleation expansion and collision of bubbles. I will review recent progress done using holography on the obtention of the wall velocity, a crucial parameter for the estimation of the spectrum of gravitational waves. I will additionally propose an alternative mechanism to bubble nucleation, arising difference in the subsequent dynamics as well as in the gravitational wave spectrum.

17. **Leonardo Santilli - 5d theories, defects and F-theorems**

    I will discuss 5d supersymmetric field theories enriched by defects from three complementary perspectives: M-theory, Type IIB string theory and the gauge theory. I will study defect partition functions on the sphere via localization and present results for RG flows in the large N limi, showing the agreement with the M-theory and type IIB string theory predictions. I will also discuss a 5d F-theorem as well as present results and puzzles for defect F-theorems.

18. **Fiona Seibold - Integrable deformations of AdS3 superstrings**

    I will present recently constructed multi-parameter integrable (in principle exactly solvable) deformations of AdS3 superstrings. Generically, these eta and lambda deformations break all the supersymmetries and have a hidden quantum group symmetry. In the special case of AdS3, half of the original supersymmetries can be preserved. The eta-deformed backgrounds then share some properties with the undeformed one (in particular a trivial dilaton and regular geometry), which makes their analysis particularly interesting in the context of the AdS/CFT correspondence. I will also discuss how the different integrable deformations are related through Poisson-Lie duality.

19. **Javier Subils - A holographic view on monopoles, baryons and confinement**

    Understanding the phase diagram of QCD at finite density and temperature remains one of the most prominent open problems in modern physics. I will present a model in type IIA supergravity that describes holographically a QCD-like theory at strong coupling. The theory possesses a global conserved current corresponding to a U(1) baryon symmetry. I will show what the phase diagram at finite temperature and baryon chemical potential looks like. In particular, it possesses a line of first-order phase transitions between a confined baryonic superfluid phase and a deconfined baryonic ferromagnetic phase.

20. **Marcia Tenser - Interpolating Wilson loops and RG flows**

    There is a rich moduli space of BPS Wilson loops in 3d supersymmetric Chern-Simons-matter theories that is described by parameters that continuously interpolate between different representatives. These parameters renormalize, leading to non-trivial RG flows connecting different line defects in the gauge theory. Such renormalization has been unnoticed until very recently and we also find that the prescription can be extended to non-BPS defects as well.

5 Posters

1. **Sergio Ernesto Aguilar Gutiérrez - Euclidean wormholes in de Sitter space**

   Motivated by topological fluctuations of the Euclidean path integral in cosmological spacetimes, we construct novel de-Sitter instanton solutions for a generic Einstein-axion theory in arbitrary dimensions. We study their on-shell action, and the associated partition function describing fluctuations with respect to the Gibbons-Hawking (GH) instanton. We then perform the instanton stability analysis against 1-loop semiclassical fluctuations. Our results show that Euclidean single-axion Euclidean wormholes are perturbatively stable in $d = 4$ dimensions. We draw the physical interpretation of our results in terms of baby universe pair creation and the possible proliferation of baby multiverses. Based on work in progress with Thomas Hertog, Rob Tielemans and Thomas Van Riet.

2. **Marti Berenguer Mimo - Holographic Floquet states in low dimensions**

   I'll discuss our recent work, in which we study holographically a strongly coupled (2+1)-dimensional gauge theory subject to an external rotating electric field, both at zero and non-zero temperature. The system is modelled holographically as a D3/D5 probe intersection, and we analyze the phase diagram. We find a conductive phase and an insulating phase, and we observe that the conductive phase extends down to vanishing external electric field at discrete values of the frequencies where vector meson Floquet condensates form. For all temperatures, at given intercalated frequencies, we find new dual states that we name Floquet suppression points, where the vacuum polarization vanishes even in the presence of an electric field. From the data we infer that these states exist both in the conductive and insulating phases. In the massless limit we find a linear and instantaneous conductivity law, recovering known general results in 2+1 dimensions. We also examine the photovoltaic AC and DC current as the response to an oscillating probe electric field and see that rising the temperature suppresses the photovoltaic Hall current. All the results obtained carry over qualitatively unaltered to the case of D3/D7.

3. **Romina Ballesteros - On scalar charges and black-hole thermodynamics**

   We revisit the first law of black hole thermodynamics in 4-dimensional theories containing scalar and Abelian vector fields coupled to gravity using Wald's formalism and a new definition of scalar charge as an integral over a 2-surface which satisfies a Gauss law in stationary black-hole spacetimes. We focus on ungauged supergravity-inspired theories with symmetric sigma models whose symmetries generate electric-magnetic dualities leaving invariant their equations of motion. Our manifestly duality-invariant form of the first law is compatible with the one obtained by of Gibbons, Kallosh and Kol. We also obtain the general expression for the scalar charges of a stationary black hole in terms of the other physical parameters of the solution and the position of the horizon, generalizing the expression obtained by Pacilio for dilaton black holes.

4. **Davide Bason - A new algorithm for Grassmann integrations in superdiagrams**

   We describe a novel diagrammatic procedure to carry out the Grassmann integration in 4d N=1 superdiagrams, alternative to the well known D-algebra approach. We develop it in detail for N=2 SYM-like theories theories containing vector plus massless chiral and antichiral superfields, but it can be extended to other cases. This method is algorithmic; we implemented it as a Mathematica program that, given the description of a super Feynman diagram in momentum space, returns directly the polynomial in the momenta produced by the Grassmann integration. This communication is based on arXiv:2301.11717.

5. **Bercel Boldis - Segmented strings and holographic entanglement entropy**

AdS/CFT correspondence connects quantum entanglement and the phenomena of gravity. One result of the correspondence is provided by the so called Ryu-Takayanagi formula. This formula relates the areas of minimal surfaces of an arbitrary dimensional, asymptotically anti de Sitter space and the entanglement entropies of certain subsystems in a one lower dimensional conformal field theory living on the boundary of the AdS space. Using this result for the vacuum state of a CFT we have derived a similar formula between the area of segmented strings propagating in three, and general odd dimensional AdS spaces and the entanglement entropies of particular boundary subsystems. We have also shown that in three dimensions the positivity of string area is related to the strong subadditivity of these subsystems in the boundary theory. This duality gives a basic example how the geometry of spacetime probed by propagating strings is connected to quantum entanglement in a holographic manner.

6. **Vasil Dimitrov - Black holes arising from M5-branes: higher derivative corrections and M- theory embedding**

   In this talk I will present novel aspects of black holes arising from wrapping stacks of M5-branes on a Riemann surface. In the first part of the talk, I will discuss a precise holographic match between: 1) the higher-derivative corrected Euclidean on-shell action of the most general 5d black hole, dubbed CCLP, residing in 5d minimal gauged supergravity, and 2) the leading and sub-leading in large-N terms of the expansion of the superconformal index of the dual 4d $\mathcal{N} = 2SCFT$. I will also discuss the sub-leading corrections to the entropy and the black hole charges and various challenges that arise in calculating them. In the second part of the talk, I will explicitly show how the CCLP black hole can be uplifted, first on a Riemann surface to a consistent truncation of 7d gauged supergravity, and then to M-theory. In the process, I will describe how one uplifts the spinor variation equations in addition to the action and the equations of motion. Finally, I will provide an argument of the existence of a more general black hole than CCLP, dual to a 4d $\mathcal{N} = 2$ theory with an additional flavour fugacity, and discuss avenues for explicitly constructing it and which supergravity theory might host it.

7. **Ali Fatemiabhari - Wilson loops for 5d and 3d conformal linear quivers**

   Studying conformal and supersymmetric field theories in different dimensions and categorising Type II backgrounds with AdSd+1 factors as their holographic duals in d dimensions is of deep interest. In this poster, we focus on the case of conformal and supersymmetric quiver field theories in three and five dimensions which preserve eight Poincare supercharges. We will be interested in Wilson loops which can be computed exactly in SUSY gauge theories. We present the expressions for Wilson loops in antisymmetric representations within the electrostatic formulation of holographic duals to linear balanced quivers in five and three dimensions. We mention a relation between Wilson loops in ?electric? and the ?magnetic? descriptions for three-dimensional quivers, which can be recognised as mirror descriptions. This poster is based on arXiv:2209.07536.

8. **Michele Galli - Consistent truncations to three dimensional supergravity**

   Exceptional field theory has proven to be an extremely powerful tool to construct consistent truncations of type II supergravity to lower dimensions. The three dimensional case is particularly interesting because 3-d gauged supergravities come with very exotic gaugings, the poster will present how we used ExFT to classify which of those theories can arise from Compactifications. We have also constructed new N=16 truncations of IIA/IIB supergravity on S^7 and an N=4 truncation on S^5 fired over a Riemann surface which contains AdS3 vacua. More recently we have constructed a new supersymmetric truncation on S3xS3xS1, which again contains an AdS3 vacuum and we used ExFT to study and uplift its deformations.

9. **Pau Garcia Romeu - Disordered Holographic Superconductors at finite charge density**

We build fully back-reacted charged black hole solutions in asymptotically AdS_3 space-time with disordered boundary conditions for a $U(1)$ gauge field and a charged scalar. These black holes ought to be holographically dual to a strongly coupled theory with Harris-relevant disorder sourced by the random profile of the charge density. In this dual system, we study the fate of the superconducting phase transition which in the presence of disorder becomes a Griffiths-like phase transition. As well as the IR of the theory both in the normal and superconducting phases, finding some disagreement with the naive expectation from the Harris criterion.

10. **Silvia Georgescu - Infinite TT?-like symmetries of asymptotically linear dilaton background**

    We show that the three-dimensional asymptotically linear dilaton background that arises in the near-horizon decoupling region of NS5-branes compactified on T^4 admits boundary conditions that lead to an infinite set of symmetries. The associated conserved charges, which implement field-dependent coordinate transformations, are found to be identical to the corresponding generators in a symmetric product orbifold of $T\bar{T}$ - deformed CFTs. The asymptotic symmetry algebra is a non-linear modification of the Virasoro $\times$ Virasoro algebra, which precisely coincides with the algebra of symmetry generators in $T\bar{T}$ -deformed CFTs. This further strengthens a previously proposed link between the single-trace $T\bar{T}$ deformation and compactified little string theory. Yes Infinite $T\bar{T}$-like symmetries of asymptotically linear dilaton background We show that the three-dimensional asymptotically linear dilaton background that arises in the near-horizon decoupling region of NS5-branes compactified on T^4 admits boundary conditions that lead to an infinite set of symmetries. The associated conserved charges, which implement field-dependent coordinate transformations, are found to be identical to the corresponding generators in a symmetric product orbifold of $T\bar{T}$ - deformed CFTs. The asymptotic symmetry algebra is a non-linear modification of the Virasoro $\times$ Virasoro algebra, which precisely coincides with the algebra of symmetry generators in $T\bar{T}$ -deformed CFTs. This further strengthens a previously proposed link between the single-trace $T\bar{T}$ deformation and compactified little string theory.

11. **Camilo las Heras Guverneur - Type IIB parabolic (p,q)-strings, striclty q-strings, from M2-branes with fluxes**

    We extend the work of Schwarz to show that bound states of type IIB supersymmetric (p, q)-strings on a circle are associated with M2-branes irreducibly wrapped on T^2, or equivalently with nontrivial worldvolume fluxes. Beyond this extension we consider the Hamiltonian of an M2-brane with $C_\pm$ fluxes formulated on a symplectic torus bundle with monodromy. In particular, we analyze the relevant case when the monodromy is parabolic. We show that the Hamiltonian is defined in terms of the coinvariant module. We also find that the mass operator is invariant under transformations between inequivalent coinvariants. These coinvariants classify the inequivalent classes of twisted torus bundles with nontrivial monodromy for a given flux. We obtain their associated (p, q)-strings via double dimensional reduction, which are invariant under a parabolic subgroup of $SL(2, \mathbb{Q})$. This is the origin of the gauge symmetry of the associated gauged supergravity. These bound states could also be related to the parabolic Scherk-Schwarz reductions of type IIB string theory.

12. **John Donahue - Quantization of the Zigzag Model**

    The zigzag model is a relativistic integrable N-body system describing the leading high-energy semiclassical dynamics on the worldsheet of long confining strings in massive adjoint two-dimensional QCD. We discuss quantization of this model. We demonstrate that to achieve a consistent quantization of the model it is necessary to account for the non-trivial geometry of phase space. The resulting Poincare invariant integrable quantum theory is a close cousin of TTbar-deformed models.

13. **Lorenzo Lacobacci - Celestial Correlators from AdS space**

    Recently, flat space holography has been a subject of growing interest in relation to scattering amplitudes. So far indeed most works have focused on going from scattering amplitudes to celestial correlators. I will describe an alternative perspective which focuses on recovering celestial correlators from AdS/CFT via suitable analytic continuations similar to those in the context of dS/CFT.

14. **Tanay Kibe - Quantum thermodynamics of holographic quantum channels and the quan- tum null energy condition**

    Quantum thermodynamics determines bounds on resources like energy etc needed for operating quantum channels. However, explicit results are known in this emerging discipline only for finite dimensional systems. We have shown that the quantum null energy condition (QNEC) implements quantum thermodynamic restrictions on transitions in 2D holographic CFTs, giving strict lower and upper bounds on (positive) irreversible entropy production and thus generalizing the Clausius inequality as reported earlier in case of finite dimensional systems. We give explicit results for possible transitions after a fast energy-momentum inflow from an infinite memoryless bath for an arbitrary initial rotating thermal state PRL 128 (2022) 19, 191602. We also bear upon the question of storage of quantum information at finite temperature in 2D holographic CFTs without the need for active error correction PRL 129 (2022) 191601. Implementing a non-isometric encoding of a qubit via unitary transformation of a thermal state, and its fast erasure via a energy-momentum inflow from a bath, we derive the quantum correction to the Landauer lower bound on irreversible entropy production via requiring the validity of QNEC. Furthermore, we show that certain dense encodings, in principle realizable by current technology, are tolerant against fast erasures, evading previous no-go results for stable quantum memory at finite temperature. In forthcoming work (to appear soon), we show that the QNEC non-saturation at late time encodes information of the initial state even in the large N limit, although the correlation functions and entanglement entropy of the system thermalize to values in the final generalized Gibbs ensemble.

15. **Sonja Klisch- Waveforms from scattering amplitudes on strong backgrounds**

    Waveforms are classical observables associated with any radiative physical process. Modern calculations using scattering amplitudes in a weak field regime usually compute these to a finite order in the post-Newtonian (v/c) or post-Minkowskian (G_N) approximation. In this poster I will present an alternative approach by considering the waveform produced in the scattering of massive particles on gravitational plane waves, treated as exact nonlinear solutions of the vacuum Einstein equations. Even though the calculations are at tree-level, the waveform contains an infinite number of post-Minkowskian contributions, as well as tail, and self-force effects, when viewed as an expansion about a flat background. From the flat background perspective, these effects usually start appearing only at higher points, and higher loops. The gravitational results will be compared to, and contrasted with, analogous results in electromagnetism.

16. **Maria Knysh - Horizon supertranslations lead to chaos and pole-skipping**

    We revisit the pole-skipping phenomenon observed in chaotic many-body quantum systems, with a focus on the skipped poles in the energy-density correlator. From the standpoint of effective field theory, chaos in such systems arises from an effective degree of freedom: the fluid dynamic time reparameterization mode, which conserves energy. To ensure chaotic behavior, i.e., pole-skipping, the hydrodynamic theory is supplemented with an additional shift symmetry.

17. **Sayan Kumar Das - Holographic entanglement entropy for relativisitic hydrodynamic flows**

    We study the behaviour of holographic entanglement entropy (HEE) in near equilibrium thermal states which are macroscopically described by conformal relativistic hydrodynamic flows dual to dynamical black brane geometries. We compute HEE for strip-shaped subsystems in boundary dimensions d=2,3,4, which provides us with general qualitative inferences on the interplay between fluid flows and entanglement dynamics. At first, we consider the zeroth order in hydrodynamic derivative expansion, holographically described by stationary boosted black branes. Working non-perturbatively in fluid velocity, we find that, as the fluid velocity approaches its relativistic upper limit, the UV-regulated HEE exhibits a divergence, at arbitrary temperature. Also, the holographic mutual information between two relatively close subsystems vanishes at some critical fluid velocity and remains zero beyond it. We then compute HEE in an excited state of the fluid in the presence of a sound mode, considering first order in derivative expansion. As a simplified setup, we first work with non-dissipative dynamics in d=2, where the time evolution of HEE is studied in the presence of the sound mode and a propagating pressure pulse. In d= 4, we find that dissipative sound modes produce an additional dynamical UV divergence which is subleading compared to 'area law divergence'. No such divergence is observed for dissipative sound mode in d=3.

18. **Johannes Lahnsteiner - Wrapped M Theory Revisited**

    A complete understanding of M theory remains elusive. In this talk, I revisit a particular limit known as the wrapped membrane theory. It is defined as the zero Planck length limit with a critically tuned three-form and retains some of the stringy nature of the theory. In this talk, I present a new understanding of the underlying background structure and extend it by including supersymmetry. This will lead me to present a new supergravity multiplet in eleven dimensions. Contrary to the usual multiplet, it is manifestly non-Lorentzian. Finally, I will use this structure of this supergravity to conjecture dualities to other limits of M theory. (based on upcoming work with E. Bergshoeff, C. Blair, and J. Rosseel)

19. **Timotej Lemut - Reconstruction of holographic QFT spectra**

    Assuming only a known dispersion relation of a single mode in the spectrum of a meromorphic two-point function (in the complex frequency plane at fixed wavevector) in some quantum field theory, we investigate when and how the reconstruction of the complete spectrum of physical excitations is possible. In particular, we devise a constructive algorithm based on the theorems of Darboux and Puiseux that allows for such a reconstruction of all modes connected by level-crossings. We present the results on an example of transverse momentum excitations in the holographic theory that describes a stack of M2 branes and includes momentum diffusion as its gapless excitation. Finally, we show that even the gapless excitation can be reconstructed from the knowledge of pole-skipping points alone.

20. **Subhajit Mazumdar - Classical observables from partial wave amplitudes**

    We study the formalism of Kosower-Maybee-OConnell (KMOC) to extract classical impulse from quantum amplitude in the context of the partial wave expansion of a 2-to-2 elastic scattering. We take two complementary approaches to establish the connection. The first one takes advantage of Clebsch-Gordan relations for the base amplitudes of the partial wave expansion. The second one is a novel adaptation of the traditional saddle point approximation in the semi-classical limit. In the former, an interference between the S-matrix and its conjugate leads to a large degree of cancellation such that the saddle point approximation to handle a rapidly oscillating integral is no longer needed. As an example with a non-orbital angular momentum, we apply our methods to the charge- monopole scattering problem in the probe limit and reproduce both of the two angles characterizing the classical scattering. A spinor basis for the partial wave expansion, a non-relativistic avatar of the spinor-helicity variables, plays a crucial role throughout our computations.

21. **Joseph McGovern - Calabi-Yau modularity and black holes**

    We present a number of novel rank-two attractor points for one-parameter Calabi-Yau threefolds. With these moduli, such threefolds are conjectured to be weight-four modular, as supported by a plethora of computational evidence. It is already widely demonstrated that the periods (in turn, the semiclassical entropy) can be expressed in terms of L-values associated to the corresponding modular forms. In this work we exploit mirror symmetry in order to express the attractor values as infinite sums incorporating Gromov-Witten invariants of the mirror manifolds. The expression typically diverges, but this can be cured with a Pad resummation. In some examples that exhibit distinct mirrors, infinite sums involving the GW invariants of each mirror manifold can be expressed using the same set of L-values. Based on work in progress with Philip Candelas, Xenia de la Ossa, and Pyry Kuusela.

22. **Unai de Miguel Sarraga - Complete nonlinear action for 10D multiple D0-brane system**

    We present an action for the dynamical system of N nearly coincident multiple D0-branes and strings connecting these D0-branes (mD0 system) which possesses, besides spacetime (type IIA target superspace) supersymmetry invariance, the local worldline supersymmetry generalizing the kappa-symmetry of single D0-brane action (massive D=10 superparticle or Dirichlet superparticle). This action includes an arbitrary nonvanishing function M(H) of the relative motion Hamiltonian H. The 10D mD0 model with a particular form of M(H) can be obtained by dimensional reduction from the action of the D=11 multiple M-wave (mM0) system.

23. **Javier Moreno - Generalized quasi-topological gravities: the whole shebang**

    Generalized quasi-topological gravities (GQTGs) are higher-curvature extensions of Einstein gravity in D-dimensions. Their defining properties include possessing second-order linearized equations of motion around maximally symmetric backgrounds as well as non-hairy generalizations of Schwarzschilds black hole characterized by a single function f(r), which satisfies a second-order differential equation. Previously, GQTGs were shown to exist at all orders in curvature and for general D. In this paper we prove that, in fact, n-1 inequivalent classes (as far as static and spherically symmetric solutions are concerned) of order-n GQTGs exist for . Amongst these, we show that oneand only onetype of densities is of the quasi-topological kind, namely, such that the equation for f(r) is algebraic, except for D=4. In these theories, the thermodynamic charges of the most general D-dimensional order-n GQTG, verify that they satisfy the first law and provide evidence that they can be entirely written in terms of the embedding function which determines the maximally symmetric vacua of the theory.

24. **Kiarash Naderi - Space-time spectrum from the world-sheet in an AdS/CFT correspondence**

    The tensionless string theory on $\mathrm{AdS}_3 \times \mathrm{S}^3 \times \mathbb{T}^4$ with one unit of NS-NS flux is dual to the symmetric orbifold of $\mathbb{T}^4$. This holographic correspondence has the advantage that one has enough analytical control over both sides of the duality. In particular, the string theory is best described in the hybrid formalism of Berkovits, Vafa and Witten (BVW). However, this formalism is in general quite complicated, e.g. the physical states are described by a double cohomology. In this poster, working with the BVW formalism, we explain how one can explicitly see that the string theory contains the space-time spectrum and therefore provide a derivation of the dual spectrum from first-principles. In fact, $\mathfrak{psu}(1,1|2)_1$, the supersymmetric affine algebra describing $\text{AdS}_3 \times \text{S}^3$ in the tensionless limit, attains a free-field representation. Using bosonisation of these free fields, we construct the DDF operators of the free bosons and the free fermions of $\mathbb{T}^4$ and we show that the DDF operators reproduce the whole spectrum of the space-time theory on the world-sheet. Based on arXiv:2208.01617.

25. **Beat Nairz - Super Covering Maps**

For symmetric product orbifolds of two-dimensional SCFTs, we extend the covering map construction of Lunin and Mathur (arxiv.org/abs/hep-th/0006196) to the manifestly supersymmetric case. Correlators with insertions of twist fields can be computed using branched superconformal maps between super Riemann surfaces. For the orbifold of $\mathbb{T}^4$, the super covering map can be seen to appear in the dual tensionless string theory on $\text{AdS}_3 \times S^3 \times \mathbb{T}^4$. Worldsheet Ward identities are solved by a Berezin integration over super covering maps, giving a supersymmetric extension of the bosonic analysis presented in arxiv.org/abs/2009.11306.

26. **Gianbattista-Piero Nicosia - (Extremal) Charged Blackfolds in (A)dS**

By exploiting the blackfold approach, we construct new classes of higher-dimensional rotating black holes with various charges in Anti-de Sitter and de Sitter spacetimes in the limit where the cosmological constant is much smaller than the horizon size. While the method used is valid for any (combination of) q-brane charges, we will consider explicit examples of black p-branes carrying (0,p) or (1,p)-brane charges in the context of supergravity. We study the extremal limits of these solutions and show that, analogously to the flat spacetime constructs, we can obtain null wave branes.

27. **Praxitelis Ntokos - BPS black holes uniqueness theorems in gauged supergravities**

In this talk, I will describe recent progress on the classification of supersymmetric AdS_5 black holes in N=2 gauged supergravity. For solutions with a torus symmetry, this classification reduces to a problem in toric Kahler geometry which is most conveniently formulated in terms of a symplectic potential. The singular behaviour of the latter at the boundary of the orbit space encodes the horizon and axis structure of any possible BPS black hole spacetime within the toric class. I will also present the first uniqueness theorem(s) for supersymmetric AdS_5 black holes both in the minimal theory and the STU model for toric Kahler surfaces which enjoy some separability properties.

28. **Luca Armando Nutricati - On the Running of Gauge Couplings in String Theory**

In this talk I provide a general analysis of the running of gauge couplings within closed string theories. Unlike previous discussions in the literature, the calculation I present fully respects the underlying modular invariance of the string and includes the contributions from the infinite towers of string states which are ultimately responsible for many of the properties for which string theory is famous, including an enhanced degree of finiteness and UV/IR mixing. In order to perform the computation, I adopt a formalism that was recently developed for calculations of the Higgs mass within such theories, and demonstrate that this formalism can also be applied to calculations of gauge couplings. In general, this formalism gives rise to an on-shell effective field theory description in which the final results are expressed in terms of supertraces over the physical string states, and in which these quantities exhibit an EFT-like running" as a function of an effective spacetime mass scale. However, the calculation of the gauge couplings differs in one deep way from that of the Higgs mass: while the latter results depend on purely on-shell supertraces, the former results have a different modular structure which causes them to depend on off-shell supertraces as well. Although our results yield the expected logarithmic running of the gauge couplings within certain energy scales, they also yield a number of intrinsically stringy behaviors that transcend what might be expected within an effective field theory approach.

29. **Yorgo Pano - Symmetries in celestial CFT**

    Matching the symmetries between bulk and boundary theories is crucial in order to establish any holographic duality. For asymptotically flat spacetimes I will demonstrate how we can systematically treat symmetries related to soft theorems from the boundary perspective, using only conformal field theory considerations. I will show that the soft operators obey (generalized) conservation laws and lay out a unified method for constructing the corresponding charges. In two dimensions there are infinite towers of such charges corresponding to the enhancement of global symmetries (e.g. Poincar) to local ones (BMS). In contrast, there are finitely many symmetries in higher dimensions and non-trivial charges are obtained from soft theorems only after a shadow transform. Interestingly, this shadow transform can be understood as the action of a special class of differential operators that follows from conformal representation theory.

30. **Salvatore Raucci - Stability and flux compactifications of non-supersymmetric strings**

    Non-supersymmetric string theories display a generic runaway behavior for the dilaton, which is a cause for concern in ten dimensions. The same ingredient, considered as a scalar potential in geometric compactifications, is a welcome feature when accompanied by fluxes and internal curvature. In this poster, I will present old and new (RR and gauge) flux compactifications based on balancing the dilaton tadpole, and comment on the relevance of string corrections. Then, I will outline a procedure that resembles supersymmetry to generate solutions to the ten-dimensional equations of motion. Although this strategy does not include fluxes, a natural notion of energy suggests interesting conclusions on vacuum stability.

31. **Nicolo Risso - Quantum Gravity Bounds on N=1 Effective Theories in Four Dimensions**

    We propose quantum gravitational constraints on effective four-dimensional theories with N=1 supersymmetry. These constraints arise by demanding consistency of the worldsheet theory of a class of axionic strings whose existence follows from the Completeness Conjecture. Modulo certain assumptions, we derived positivity bounds and quantization conditions for the axionic couplings to the gauge and gravitational sector at the two- and four-derivative level, respectively. We furthermore obtained general bounds on the rank of the gauge sector in terms of the gravitational couplings to the axions. Such bounds have been tested and further motivated in concrete string theoretic settings. In particular, this leads to a sharper version of the bound on the gauge group rank in F-theory on elliptic four-folds with a smooth base, which improves the known geometrical Kodaira bounds. We furthermore provided a detailed derivation of the EFT string constraints in heterotic string compactifications including higher derivative corrections to the effective action and apply the bounds to M-theory compactifications on G2 manifolds.

32. **Elia de Sabbata - Analytic bootstrap in critical O(N) line defect models**

    The analytic bootstrap is a powerful technique that allows one to extract information about the spectrum and the OPE coefficients in conformal field theories. In the case of conformal defects, where part of the conformal symmetry is explicitly broken, one can still apply analytic bootstrap techniques with some due modifications. In particular, if the CFT data can be expanded as a formal series in some parameter, one can perturbatively determine the series coefficients using only general considerations about the theory and very little additional input. In our work, we focus on a specific application of these very general ideas to the case of line defect theories in $d = 4 - \epsilon$ where the bulk is the critical O(N) model. For instance, this leads to the extraction of an infinite amount of new CFT data at once. The results show the great utility of this method also in cases where it would be possible but inefficient to perform standard diagrammatic calculations.

33. **Adrián Sánchez Garrido - Krylov complexity, chaos and wormholes**

Krylov complexity is a notion of quantum complexity that quantifies the progressive exploration of the available Hilbert space by a state (or operator) during its time evolution. It does so by measuring the position expectation value with respect to an orthonormal basis (the Krylov basis, or chain) whose states contain increasing powers of the Hamiltonian (or the Liouvillian, in the operator case). The dynamics of the spreading through this basis are equivalent to a one-dimensional hopping problem. I will first explain results on the connection between the chaotic or integrable nature of systems and the scrambling or localization effects on the Krylov chain. Next, I will present recent results on the exact correspondence between Krylov complexity and bulk two-sided length in the case of double-scaled SYK and its JT gravity dual.

34. **Sanjit Shashi - Transport Across Interfaces in Symmetric Orbifolds**

A general classification of conformal interfaces has long been lacking in the literature. One approach is to map interfaces to conformal boundaries, then to use the tools of boundary CFT to extract specific physical data encoded by an associated boundary state. Guided by this, we examine how boundary states encode energy transport coefficients—i.e. transmission and reflection probabilities—of the related conformal interfaces in symmetric orbifold theories, which constitute a large class of irrational theories and are closely related to holographic setups. At the orbifold point, we find that the transport coefficients are only informed by untwisted-sector terms in the boundary states and so are averages of coefficients in the underlying seed theory. Following that, we then study the symmetric orbifold of the $\mathbb{T}^4$ sigma model ICFT dual to type IIB supergravity on the 3d Janus solution. The Janus solution can be used to compute transport coefficients of particular interfaces in the strongly coupled regime of the symmetric orbifold theory (far from the orbifold point). We compare these coefficients to that of the free theory, finding that the profile of the transmission coefficient changes functionally and overall increases with the coupling.

35. **Arvind Shekar - Entanglement Entropy and islands on a d dimensional AdS black hole**

The study of entanglement entropy (EE) in field theories with gravity has been fruitful in uncovering the inconsistencies within our theories, such as the information paradox, and has also provided us with a direction to resolve them. Motivated by studies of EE using the AdS/CFT conjecture, there has been a recent (2019) proposal in (1+1) dim JT gravity called islands that possibly resolve the paradox. Are there islands on a general dimensional AdS black hole background? We will explore and try to answer this. In the process, we will also understand the subtleties in calculating EE on this background (EE has mostly been studied in 2 dim and flat background). We will also review the notion of EE in QFTs, how to calculate it, what it implies for black holes and what we can learn using AdS/CFT.

36. **Vit Sriprachyakul - Perturbing the symmetric orbifold from the worldsheet**

Recently there have been many explicit checks done for a particular AdS/CFT, namely, a string theory on $AdS_3 \times S^3 \times \mathbb{T}^4$ in a tensionless limit and the CFT is a symmetric product orbifold of $\mathbb{T}^4$ theory. The symmetric orbifold of $\mathbb{T}^4$ is the analogue of free SYM in four dimensions. In this talk we discuss the deformation of this exact AdS/CFT duality away from the free point. On the symmetric orbifold side this amounts to perturbing the theory by the exactly marginal operator from the 2-cycle twisted sector. We identify the corresponding perturbation in the dual worldsheet description, and show that the anomalous conformal dimensions of a number of symmetric orbifold currents are correctly reproduced from this worldsheet perspective.

37. **Hareram Swain - A simple model for strange metallic behavior: Universal spectral function and transport**

    The measurement of the spectral function via ARPES has given us key insights into the nature of elementary constituents of strange metals. It has been shown via Wilsonian RG approach that semi-holographic models of non-Fermi liquids with arbitrary interactions exhibit generalized quasi-particles in the large N limit whose low frequency behavior is exactly as in Faulkner-Polchinski's model of linear hybridization of lattice electrons with a critical fermion. Considering only the two leading effective couplings, we show that the spectral function near the Fermi surface takes a universal form over a wide range of temperatures and frequencies, which is remarkably independent of all model parameters including the critical exponent, when the ratio of the two couplings is near the value corresponding to optimal doping. Our spectral function fits the nodal ARPES data of BISCO samples very well over a wide range of temperatures and for underdoped/ptimally-doped/overdoped samples with the same value of the critical exponent. We derive the linear-in-T dc resistivity and also a refined version of Planckian dissipation from the universal spectral function that is well supported by experimental data. We will also discuss computations of optical conductivity, their remarkable agreements with experimental data at low frequencies, and a new way to extract the Planckian scattering time. (ref:arXiv:2206.01215).

38. **Bilyana Tomova - Phase Space Renormalization and Finite BMS Charges in Six Dimensions**

    Large gauge symmetries of asymptotically flat Einstein gravity in 4 dimensions are extremely well understood. The asymptotic symmetry group is infinite dimensional, and the Ward identities of the associated charges lead to the infinitely many soft theorems of gravitational scattering. These infinitely many soft theorems exist in 6 dimensions as well. However, the construction of the corresponding charges has long remained elusive. In this talk I will present a way of constructing a consistent phase space of asymptotically flat Einstein gravity in 6 dimensions. In contrast with previous work, this phase space allows for the existence of super-rotations. Furthermore, I will explain how one can normalize the associated charges using an ambiguity in the symplectic form of gravity. Yes Phase Space Renormalization and Finite BMS Charges in Six Dimensions Large gauge symmetries of asymptotically flat Einstein gravity in 4 dimensions are extremely well understood. The asymptotic symmetry group is infinite dimensional, and the Ward identities of the associated charges lead to the infinitely many soft theorems of gravitational scattering. These infinitely many soft theorems exist in 6 dimensions as well. However, the construction of the corresponding charges has long remained elusive.I will present a way of constructing a consistent phase space of asymptotically flat Einstein gravity in 6 dimensions. In contrast with previous work, this phase space allows for the existence of super-rotations. Furthermore, I will explain how one can normalize the associated charges using an ambiguity in the symplectic form of gravity.

39. **Xuao Zhang - 4d N = 2 orientifold SCFT: a numerical study of two- and three-point functions and Wilson loops**

    We study correlation functions of local operators and Wilson loop expectation values in the planar limit of a 4d N = 2 superconformal SU(N) YM theory with hypermultiplets in the symmetric and antisymmetric representations of the gauge group. This so-called E theory is closely related to N = 4 SYM and has a holographic description in terms of a Z2 orientifold of AdS5 x S5. Using recent matrix model results based on supersymmetric localization, we develop precise numerical methods to calculate two- and three-point functions of certain single trace operators as well as 1/2-BPS Wilson loop expectation values as a function of the t Hooft coupling. We use our numerical results to arrive at simple analytic expressions for these correlators valid up to the sixth order in the strong coupling expansion. These results provide explicit field theory predictions for the alpha' corrections to the supergravity approximation of type IIB string theory on the AdS5 x S5/Z2 orientifold.

40. **Bin Zhu - Celestial Liouville theory for Yang-Mills amplitudes and Celestial Supersymmetry**

    We consider Yang-Mills theory with the coupling constant and theta angle determined by the vacuum expectation values of a dynamical (complex, zero mass) dilaton field. We discuss the tree-level N-gluon MHV scattering amplitudes in the presence of a nontrivial background dilaton field and construct the corresponding celestial amplitudes by taking Mellin transforms with respect to the light cone frame energies. In this way, we obtain two-dimensional CFT correlators of primary fields on the celestial sphere. We show that the celestial Yang-Mills amplitudes evaluated in the presence of a spherical dilaton shockwave are given by the correlation functions of primary field operators factorized into the holomorphic current operators times the light Liouville operators. They are evaluated in the semiclassical limit of Liouville theory (the limit of infinite central charge) and are determined by the classical Liouville field describing metrics on the celestial sphere. We also discuss supersymmetric Yang-Mills theory coupled to dilatons. We show that in the presence of suitably chosen pointlike dilaton sources, the CCFT operators associated with the gauge supermultiplet acquire a simple, factorized form. They factorize into the holomorphic (super)current part and the exponential light operators of Liouville theory, in the infinite central charge limit. The current sector exhibits (1,0) supersymmetry, thus implementing spacetime supersymmetry in CCFT.