Geometry, Duality and Strings 2018

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Book of Abstracts

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Non-supersymmetric Black Hole Microstates in Supergravity and String Theory

Author: David Turton[1]

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I will describe recent progress in our understanding of non-supersymmetric black hole microstates through the construction of new families of supergravity solutions, as well as the construction and study of new string worldsheet CFTs describing string dynamics on non-supersymmetric black hole microstate backgrounds.

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Alpha prime corrected solutions of the heterotic string

Author: Tomas Ortin Miguel[1]

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We describe a family of solutions of the heterotic string effective action to first order in alpha prime. At lowest order, these solutions correspond to well known 4 and 5 dimensional black holes and, with our results, their first order corrections can be found and studied explicitly for the first time in the literature. We show how non-Abelian instantones can reduce or eliminate these corrections.

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On Freudenthal Duality

Author: Alessio Marrani[None]

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Freudenthal duality can be defined as an anti-involutive, non-linear map acting on symplectic spaces. After a general introduction on some aspects of Maxwell-Einstein (super)gravity theories in four dimensions, I will consider their electric-magnetic duality Lie groups "of type E7", and the corresponding notion of Freudenthal duality.
I will also comment on the relation between the Hessian of the black hole entropy and the rigid, special Kaehler manifolds given by the pre-homogeneous vector spaces associated to the duality orbits.

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Coordinate space approach to double copy

Author: Michael Duff[1]

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We report on recent progress in relating gravity to the product of two Yang-Mills theories from the point of view of fields in coordinate space rather than on-shell scattering amplitudes in momentum space.

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α'-corrected black holes in Heterotic String Theory

Author: Pedro F. Ramírez[1]

[1] *INFN Milano*

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I will present the first-order in α' corrections to a 3-charge black hole in Heterotic Superstring Theory with the possible addition of SU(2) Yang-Mills fields. All the calculations are carried out in the 10-dimensional theory, avoiding the problems posed by the dimensional reduction or the supersymmetry completions of 5-dimensional actions. Since the solution covers the asymptotically-flat region and not just the near-horizon region, it is possible to compute the conserved charges and fundamental constituents directly. I will discuss the behaviour under α'-corrected T-duality, as well as the correction to the black hole entropy, which is in agreement with CFT computations.

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Non-perturbative decay of non-Abelian hair

Author: Pablo Antonio Cano[1]

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We construct a solution of Heterotic supergravity which interpolates between two different AdS3 × S3 × T4 geometries corresponding to the near-horizon limits of two 5-dimensional black holes, only one of which has non-Abelian hair. This solution can be used to estimate the amplitude of probability of the non-perturbative decay of the gauge 5-brane responsible for the non-Abelian hair into eight solitonic 5-branes by evaluating its Euclidean action. The Wick rotation of this solution poses several problems which we argue can be overcome by using a non-extremal off-shell (NEOS) deformation of the solution. This NEOS field configuration can be Wick rotated straight away and its Euclidean action can be computed for any value of the deformation parameter. The Euclidean result can then be anti-Wick-rotated and its extremal limit gives the Euclidean action of the original solution, which turns out to be one half of the difference between the entropies of the 5-dimensional black holes.

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Microstate geometries and the CTCs problem

Author: Alejandro Ruipérez[1]

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Microstate geometries are smooth horizonless solutions of supergravity theories, which are claimed to represent the classical description of the microstates of a black hole. So far, no systematic procedure to construct these type of solutions was known. I will talk about the results of arXiv:1709.03985, where we argue that the problem of constructing explicit solutions can be boiled down to the evaluation of an algebraic constraint, allowing us to design a systematic procedure to generate these solutions.

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On gauged maximal d=8 supergravity

Author: Oscar Lasso[1]

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I will talk about the gauging of maximal supergravity in 8 dimensions using the embedding tensor formalism. Focussing on SO(3) gaugings, I will show how supergravity theories with a different 11-dimensional origin are related by an SL(2,R) duality.

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Physics at the horizon - mind the cap !

Author: Iosif Bena[1]

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Black holes appear to lead to information loss, thus violating one of the fundamental tenets of Quantum Mechanics. Recent Information-Theory-based arguments imply that information loss can only be avoided if at the scale of the black hole horizon there exists a structure (commonly called fuzzball or firewall) that allows information to escape. I will discuss the highly-unusual properties that this structure must have and how these properties emerge in the realization of this structure in String Theory via branes, fluxes and topology. I will also describe the implication of this structure for AdS_2 holography.

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Gravity and the planar spin-2 Schroedinger equation

Author: Eric Bergshoeff[1]

[1] *University of Groningen, Van Swinderen Institute*

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I will give a short review of the frame-independent formulation of Newtonian gravity, called Newton-Cartan Gravity, and explain why there is a renewed interest into non-relativistic gravity in general. I will discuss, as a particular application, a recent proposal for an Effective Field Theory describing a massive spin-2 mode (the so-called GMP mode) in the Fractional Quantum Hall Effect.

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Weaving the Exotic Web

Author: Yuho Sakatani[1]

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Toroidally compactified M-theory or type II string theory contains a rich variety of exotic branes. In this talk, I will review these exotic branes and construct their supergravity solutions utilizing the framework of the double/exceptional field theory. Some of the obtained solutions depend on the winding coordinates although the section condition is not violated. The mixed-symmetry potentials and the locally non-geometric fluxes in the exotic domain-wall backgrounds, and deformations of supergravity are also discussed. This talk is based on a collaboration with Jose J. Fernandez-Melgarejo and Tetsuji Kimura.

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Yang-Baxter deformations and generalized supergravity

Author: Kentaroh Yoshida[1]

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Recently, there has been a fundamental and significant development about the Green-Schwarz (GS) formulation of superstring theory. In this formulation, the kappa-symmetry plays a central role to ensure the consistency of the theory. In 2016 Tseytlin and Wulff showed that the kappa-symmetry constraints of the GS superstring defined on an arbitrary background lead to a "generalized" supergravity, which contains an additional (non-dynamical) vector field, rather than the standard supergravity. This result indicates that we might have overlooked a potentially important ingredient in the low-energy effective theory of string theory for long time, and may open up new directions including phenomenology and cosmology. In this talk, I will briefly introduce the recent progress on the generalized supergravity by focusing upon Yang-Baxter deformations and non-geometric aspects.

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CYBE from Supergravity

Author: Eoin Ó Colgáin[1]

[1] *Asia Pacific Center for Theoretical Physics*

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We connect a puzzle in non-Abelian T-duality to generalized supergravity and show that the Classical Yang-Baxter Equation emerges from deformations of supergravity solutions in a fairly generic way.

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Symplectic duality bundles and locally geometric U-folds

Author: Carlos Shahbazi[1]

[1] *Hamburg University*

Corresponding Author: c.shahbazi@gmail.com

I will introduce the symplectic duality bundle of a generic four-dimensional supergravity theory and I will describe how it can be used to extract information on the global geometry and topology of locally geometric supergravity U-folds. Work in collaboration with C. Lazaroiu.

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Holographic interpretation of non-Abelian T-duals

Author: Jesús Montero[1]

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In this talk we will discuss non-Abelian T-duality as a solution generating technique in type II Supergravity, briefly reviewing its potential to motivate, probe or challenge classifications of supersymmetric solutions, and focusing on the open problem of providing the newly generated AdS backgrounds with consistent dual superconformal field theories. These can be seen as renormalization fixed points of linear quivers of increasing rank. As illustrative examples, we consider the non-Abelian T-duals of AdS5xS5, the Klebanov-Witten background, and the IIA reduction of AdS4xS7, whose proposed quivers are, respectively, the four dimensional N=2 Gaiotto-Maldacena theories describing the worldvolume dynamics of D4-NS5 brane intersections, its N=1 mass deformations realized as D4-NS5-NS5', and the three dimensional N=4 Gaiotto-Witten theories, corresponding to D3-D5-NS5. Based on 1705.09661 and 1609.09061.

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Local β-deformations and Yang-Baxter sigma model

Author: Junichi Sakamoto[1]

[1] *Kyoto university*

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Homogeneous Yang-Baxter (YB) deformation of $AdS_5\times S^5$ superstring is revisited.
In this talk, I explain that homogeneous YB deformations are equivalent to β-deformations of the $AdS_5\times S^5$ background when the classical r-matrices consist of bosonic generators.
If time permitted, I also discuss β-deformations of the $AdS_3\times S^3\times T^4$ with H-flux and provide various solutions of (generalized) type II supergravity.
This talk is based on arXiv:1803.05903.

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On D=6, N=(2,0) and N=(4,0) theories

Author: Leron Borsten[1]

[1] *Dublin Institute for Advanced Studies*

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We will begin with an introduction to the emerging paradigm of "gravity=gauge x gauge". Then, using a field-theoretic incarnation of this notion, we will demonstrate how that the "square"of an Abelian D=6, N=(2,0) theory yields the free D=6, N=(4,0) theory constructed by Hull, together with its generalized (super)gauge transformations. This offers a new perspective on the (4,0) theory and chiral theories of conformal gravity more generally, while at the same time extending the domain of the "gravity=gauge×gauge"paradigm. We will conclude with some related speculations on gravitational dualities.

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Instantons in AdS5 x S5/Zk

Author: Mario Trigiante[1]

[1] *Politecnico di Torino*

Corresponding Author: mario.trigiante@gmail.com

We review the recent construction of instantonic solutions in Type IIB theory on a background of the form AdS5 x S5/Zk and discuss some of their properties.

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AdS4/CFT3 holography from massive IIA

Author: Adolfo Guarino[1]

[1] *Université Libre de Bruxelles*

Dimensional reduction of supergravity theories on spheres plays a central role in the gauge/gravity correspondence. Prominent examples are the reductions of eleven-dimensional supergravity on S7 and type IIB supergravity on S5 which are dual to ABJM and N=4 SYM theories, respectively. Using the recently discovered duality between massive IIA supergravity on S6 and super Chern-Simons-matter theories, we will describe RG flows holographically in terms of domain-wall and black hole solutions in the gravity side.

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Conformal defects in 6d (1,0) theories from holography

Author: Giuseppe Dibitetto[1]

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We present a BPS flow within minimal N=1 supergravity in seven dimensions describing a warped AdS3 background supported by a "dyonic"profile of the three-form. Furthermore, we discuss the holographic interpretation of the above solution in terms of a defect SCFT2 inside the 6d (1,0) theory dual to the AdS in the asymptotic region. Finally we provide the brane picture of the aforementioned

defect CFT as D2- and wrapped D4-branes ending on a D6 –NS5 –D8 funnel in massive type IIA string theory.

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Path-Integral Complexity for Perturbed CFTs

Author: Arpan Bhattacharyya[1]

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In this talk I will formulate a path-integral optimization for two-dimensional conformal field theories perturbed by relevant operators. I will present several evidences how this optimization mechanism works, based on calculations in free field theories as well as general arguments of RG flows in field theories. Our optimization is performed by minimizing the path-integral complexity functional that depends on the metric and also on the relevant couplings. Then, we compute the optimal metric perturbatively and find that it agrees with the time slice of the hyperbolic metric perturbed by a scalar field in the AdS/CFT correspondence. Last but not the least, we estimate contributions to complexity from relevant perturbations

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Complexity Functionals and Complexity Growth Limits in Tensor Network Circuits

Author: Javier Molina-Vilaplana[1]

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Using a derivation from first principles of the path integral associated to a cMERA tensor network, we provide an operational definition for the complexity of a cMERA circuit/state which is relevant to investigate the complexity of states in quantum field theory. In this framework, it is possible to explicitly establish the correspondence (Minimal) Complexity = (Least) Action. Remarkably, it is also shown how the cMERA complexity optimizer action functional can be seen as the action of a Liouville field theory, thus showing connections with two dimensional quantum gravity. The rate of complexity growth along the cMERA renormalization group flow is obtained and shown to saturate limits which are in close resemblance to the fundamental bounds for the speed of evolution in unitary quantum dynamics, known as quantum speed limits. Finally, we show that the complexity of a cMERA circuit measured through this complexity functionals, can be casted in terms of the variationally-optimized amount of left-right entanglement created along the cMERA renormalization flow. Our results suggest that the patterns of entanglement in states of a QFT could determine their dual gravitational descriptions through a principle of least complexity.

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Quantum corrections to the dispersion relation in flux-deformed AdS_3/CFT_2

Author: Juan Miguel Nieto[1]

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In this talk I will present the computation of the one-loop correction to the classical dispersion relation of rigid closed spinning strings with two equal angular momenta in the $AdS_3 \times S^3 \times T^4$ background supported with a mixture of R-R and NS-NS three-form fluxes. This analysis is performed by means of two different methods. The first method relies on the quadratic fluctuations around the classical solution, while the second one exploits the underlying integrability of the problem through the algebraic curve. We find that the one-loop correction vanishes in the pure NS-NS limit

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Gravitational duality an deformations of action principles for mixed-symmetry tensor fields

We will review recent progress on gravitational duality and the construction of action principles for mixed-symmetry tensor fields, which describe the dual graviton in higher dimensions.

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Ghosts in Yang-Mills squared

Author: Michele Zoccali[1]

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In this talk, we will present the Yang-Mills squared approach to relating gauge theory and gravity, highlighting some of the motivations and connections to other branches of current research. We will introduce a fully BRST covariant version of this correspondence, stressing how this generalisation is not only useful, albeit necessary.

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Generalized Freudenthal transformations and Black Holes

Author: Emilio Torrente-lujan[None]

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We present a detailed description of N = 2 stationary BPS multicenter black hole solutions for quadratic prepotentials with an arbitrary number of centers and scalar fields making a systematic use of the algebraic properties of the matrix of second derivatives of the prepotential, S, which in this case is a scalar-independent matrix. The anti-involution matrix S can be understood as a Freudenthal duality $\tilde{x} = Sx$. We show that this duality can be generalized to "Freudenthal transformations"
under which the horizon area, ADM mass and intercenter distances scale up leaving constant the scalars at the fixed points. In the special case $\lambda = 1$, "S-rotations", the transformations leave invariant the solution.
Next we show that these generalized transformations leave invariant not only the quadratic preotential theories but also the general stringy extremal quartic form $_4$, $\Delta 4(x) = \Delta 4(\cos\theta x + \sin\theta\tilde{x})$ and therefore its entropy at lowest order. We make an extensive mathematical characterization of these transformations in the framework of Freudenthal triple systems.

This presentation is partiatially based in different publications made in collaboration with JJ. Fernandez-Melgarejo, A. Marrani,L.Borsten, A. Duff.

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On Freudenthal Duality

Author: Alessio Marrani[None]

Freudenthal duality can be defined as an anti-involutive, non-linear map acting on symplectic spaces. After a general introduction on some aspects of Maxwell-Einstein (super)gravity theories in four dimensions, I will consider their electric-magnetic duality Lie groups "of type E7", and the corresponding notion of Freudenthal duality.
I will also comment on the relation between the Hessian of the black hole entropy and the rigid, special Kaehler manifolds given by the pre-homogeneous vector spaces associated to the duality orbits.