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Lloyd's Baia Hotel - Vietri sul Mare (Italy)

String Theory

Chairpersons: G. Bonelli - F. Pezzella - A. Tomasiello

Friday, 18th March

Higher spins in three dimensions and BMS symmetry

Andrea Campoleoni
Université Libre de Bruxelles

We discuss how interacting models for higher-spin fields can be built in three-dimensional Minkowski space thanks to the absence of local degrees of freedom. In spite of this limitation, these models display very rich asymptotic symmetries, given by extensions of the infinite-dimensional three-dimensional local Bondi-Metzner-Sachs (BMS) algebra. We show how one can construct non-trivial unitary representations of these algebras, and how they account for all boundary excitations around the Minkowski vacuum, in analogy with what has been observed for the AdS_3 case.

Higher Spins, Holography and Locality: The Bulk Side

Massimo Taronna
Université Libre de Bruxelles

Higher-spin theories have been conjectured to be dual to relatively simple CFTs. In this talk we review the status of these dualities, focusing on two main questions: Holographic reconstruction of bulk interactions and the study of their locality properties.

Coffee break

Geometrical structures in supergravity and string theory

Michela Petrini
LPTHE Jussieu, Paris

Supergravity theories emerging as low energy effective theories of strings exhibit large symmetry groups. Much attention has been devoted in the last year in understanding the role of such symmetries in higher dimensions. In this talk I will review one possible appraoch, Generalised Geometry, from the basic ideas to applications to string compactifications, consistent truncations and the gauge/gravity correspondence.

Non-geometric heterotic vacua from F-theory

Stefano Massai
LMU, Munich

I will discuss recent progress in exploring non-geometric heterotic compactifications to six dimensions. These are described by a fibration of the T-duality group whose degenerations define stringy, non-geometric defects. By using heterotic/F-theory duality I will show how to classify the 6D theories which describe the low energy physics.

Higher gauge theory interpretation of an M5-brane model

Patricia Ritter
Università di Bologna

I will introduce the need for higher, strong homotopy algebra structures for the gauge symmetries of extended objects. We will see how the requirement that the curvatures of the higher connections vanish yield the equations of motion of (higher) gauge theories. In particular, we will see how to obtain such conditions for a Lie 2-algebra model on the "doubled" space-time T*M+TM. This is a particularly interesting example, as it reproduces the equations proposed by Lambert and Papageorgakis for effective M5-brane dynamics in arxiv:1007.2982.

Saturday, 19th March

9:30
AdS4 black holes and 3d gauge theories

Alberto Zaffaroni
Università degli Studi di Milano-Bicocca

One of the great success of string theory is the microscopical explanation of the entropy of a class of asymptotically flat black holes. Much less is known about asymptotically AdS black holes. In this talk I explain how to derive the entropy of a class of asymptotically AdS supersymmetric black holes in four dimensions using holography. The counting of black hole micro-states is related to a counting of states in the dual 3d gauge theory which can be explicitly performed using localization.

10:20
Deformed Virasoro algebras in supersymmetric gauge theories

Fabrizio Nieri
Uppsala University

The Alday-Gaiotto-Tachikawa (AGT) correspondence allows a wide class of 4d supersymmetric gauge theories to be studied in a dual 2d CFT. In particular, the gauge theory partition function is identified with a 2d CFT correlator. In this talk I will discuss how the AGT correspondence can be extended to certain 5d and 6d supersymmetric gauge theories, in which case the dual symmetry algebras are trigonometric or elliptic deformations of the Virasoro algebra.

11:00 **Coffee break**

11:30

Universal Properties of Cylinder Partition Functions

Lorenzo Di Pietro
Weizmann Institute of Science

We consider 4d N=1 superconformal theories on a cylinder. The partition function on this geometry computes the superconformal index, and can be obtained via the path integral with time direction compactified on a circle and periodic conditions for fermions. We will use an effective field theory approach to derive formulas for the asymptotics of such partition functions in the limit of very large circle and of very small circle. These limits are completely fixed in terms of coefficients of the Weyl anomaly (a,c). We will explain why supersymmetry is a necessary condition in 4d to establish these higher dimensional analogues of classic results in 2d CFTs. Finally we will discuss the extension to 6d and some applications.

12:10

Instanton strings of minimal 6d SCFTs

Guglielmo Lockhart
University of Amsterdam

A salient feature of six-dimensional superconformal theories (SCFTs) is the existence among their degrees of freedom of self-dual strings which couple to the 6d tensor multiplets. When the SCFT has a non-trivial gauge group, the strings also play the role of instantons of the gauge group. In this talk I focus on a class of 'minimal' N=(1,0) SCFTs with a single tensor multiplet and simply-laced gauge group. I show how various features of their instanton strings can be obtained from their description as wrapped D3 branes. In particular, in certain cases one is able to compute the strings' elliptic genera, which can be checked against predictions from topological string theory.

12:50 **Lunch**

15:00

Some Applications of Topological Gravity to Supersymmetric Quantum Field Theories

Camillo Imbimbo
Genoa University

After reviewing the BRST structure of topological gravity and its relation to equivariant cohomology, we describe its coupling to several matter topological field theories: two dimensional non-linear sigma-models and supersymmetric gauge theories in both two and three dimensions. In each of these contexts, grasping the peculiarities of the coupling to topological gravity allows for a simple understanding of some subtle phenomena in supersymmetric quantum field theories.

A new class of (0,2) superconformal field theories

Marco Bertolini
Duke University, Durham

In this talk I will present constructive evidence for a class of (0,2) superconformal field theories (SCFTs) based on hybrid geometries, suitable for compactifications of the heterotic string. Roughly, a hybrid theory is a non-linear sigma model (NLSM) where the target space is a Landau-Ginzburg orbifold (LGOs) fibered non-trivially over a compact Kähler base. Although the models we are going to consider are a generalization of hybrid theories with (2,2) SUSY, our approach here wll be somehow different and aimed at a possible classification result. Given their importance as a building block of the construction, I will describe (0,2) LGOs and a class of "accidents" that occour in the associated moduli spaces. I will also describe a method to compute the massless spectrum for the heterotic compactification based on a hybrid SCFT.

Coffee break

6d fixed points from holography

Luigi Tizzano
Uppsala University

Recently, there has been a considerable progress in the understanding of six dimensional conformal field theories and their relationship with holography. In this talk I will review how the brane constructions in massive type IIA can be linked to the AdS7 gravity dual solutions. Using this perspective, I will then report on some recent result which suggests the existence of a novel example of interacting and non-supersymmetric CFT in six dimensions.

T-branes through 3d mirror symmetry

Simone Giacomelli
Université Libre de Bruxelles

T-branes are exotic bound states of D-branes, characterized by mutually non-commuting vacuum expectation values for the world volume scalars, and the M/F-theory geometry lifting D6/D7-brane configurations is blind to the T-brane data. In this talk I will explain how to make this data manifest by looking at the effect of T-branes on a probe two brane. I will show that, exploiting 3d mirror symmetry, we can understand in detail how the wordvolume brane theory is modified, uncovering a new class of N=2 quiver gauge theories, whose Higgs branches mimic those of membranes at ADE singularities.

Sunday, 20th March

Spontaneously broken supergravity, constrained superfields and branes

Dimitri Sorokin
INFN, Padua Division

We will review a recent revival of interest to the study of spontaneous breaking of local supersymmetry and the super-Higgs effect in four-dimensional supergravity, related to the possibility of building relevant cosmological models with de Sitter vacua in the framework of supergravity and string theory. We will compare two realizations of this effect, one which uses constrained (nilpotent) superfields and another one involving a space-filling 3-brane. The latter can be regarded as a dimensionally reduced relic of anti-D-branes causing supersymmetry breaking and generating de Sitter vacua in corresponding stringy scenarios.

Inflation and attractors in supergravity

Marco Scalisi
University of Groningen

The latest Planck data provide stringent constraints on the parameters related to the inflationary dynamics. However, many models are still competing for the final say on the detailed mechanism of inflation. Guided by UV-completion arguments, we present α-attractors: their cosmological predictions are fully determined by some geometric properties of the underlying supergravity theory. Strikingly, they provide an excellent fit with the latest observational data. We will show how this scenario emerges very naturally from some basic theoretical ingredients. Interestingly, the coupling with a nilpotent sector responsible for dark energy and SUSY breaking will enhance the attractor nature of the theory.

Coffee break

Scattering amplitudes in N=2 Maxwell-Einstein and Yang-Mills-Einstein supergravities

Marco Chiodaroli
MPI, Potsdam

The talk reports on recent progress in amplitude computations for broad classes of N=2 Maxwell-Einstein and Yang-Mills-Einstein supergravities, using the framework provided by color/kinematics duality and the double-copy construction. After a review of the main theoretical tools, we discuss the extension of the double-copy construction to a particular infinite family of N=2 Maxwell-Einstein theories in four and five dimensions, the so-called generic Jordan family of supergravities. We show that the global symmetries of these theories can easily be gauged, giving the amplitudes of the corresponding Yang-Mills-Einstein supergravities. We also discuss how the construction can be modified to describe spontaneous symmetry breaking. Finally, we present an extension of the construction that captures an even larger class of N=2 homogeneous supergravities.

Black branes in AdS4 and a quantum critical point

Alessandra Gnecchi
KU, Leuven

We present the study of thermodynamics of charged black branes in AdS4 at zero temperature. We work in a mixed thermodynamical ensemble that includes both black branes and "thermal gas" solutions, which we construct analytically. The presence of a quantum critical point is discussed from a holographic point of view, in particular we show that the spectrum of fluctuations in the dual theory is gapped at the critical point. We conclude with comments on work in progress that extends the phase space out of zero temperature.