TFI 2022: Theories of Fundamental Interactions 2022

Report of Contributions

review talk - Information Theory i ...

Contribution ID: 1

Type: not specified

review talk - Information Theory in quantum gravity and field theory

Monday, 13 June 2022 14:00 (1 hour)

Presenter: DE BOER, Jan (Amsterdam University)

Brane evaporation in double holog ...

Contribution ID: 2

Type: not specified

Brane evaporation in double holography and entanglement islands

Monday, 13 June 2022 15:00 (35 minutes)

Doubly holographic braneworld models played an important role in understanding the role of entanglement islands. They offer three complementary perspectives: the usual AdS bulk and boundary CFT descriptions, but also a brane picture where a gravitational theory is coupled to a CFT. I will discuss ongoing work on the study of entanglement entropy in a model of braneworld evaporation. From the higher dimensional AdS bulk point of view, this system corresponds to a black hole accelerated by a domain wall with time dependent tension.

Presenter: GALLI, Federico (Istituto Nazionale di Fisica Nucleare)

TFI 2022: Theori ... / Report of Contributions

S-fold CFTs and conformal manifolds

Contribution ID: 3

Type: not specified

S-fold CFTs and conformal manifolds

Monday, 13 June 2022 15:35 (35 minutes)

Presenter: VAN MUIDEN, Jesse (SISSA)

Stringy quintessence models in the ...

Contribution ID: 4

Type: not specified

Stringy quintessence models in the swampland

Monday, 13 June 2022 17:30 (35 minutes)

The embedding of accelerated expansion, in particular our past and present cosmology, in string theory remains an open problem in string phenomenology. Certain swampland conjectures place stringent bounds on such models. In this talk I will focus on multifield quintessence in the late universe, and the search for transients close to the cosmological parameters today. I will conclude that typical stringy models do not have observationally compatible trajectories, if one starts with matter-dominated initial conditions. I will also describe universal, compatible trajectories starting from early phases of kinetic domination, however these favorable initial conditions are harder to justify.

Presenter: BRINKMANN, Max (University of Bologna and Padova)

Chiral theories dynamics from sy ...

Contribution ID: 5

Type: not specified

Chiral theories dynamics from symmetries and anomalies

Monday, 13 June 2022 18:05 (35 minutes)

In this talk, I discuss some examples of UV-free chiral gauge theories, looking at their IR effective descriptions from the point of view of symmetries and anomalies. In particular, I show how the 't Hooft anomaly matching conditions (generalized by including higher form symmetries) and the realization of symmetries (either broken or unbroken, exacts or anomalous) allow us to learn some features of the IR theory, e.g. by implying condensates we were not aware of before or by shaping the interaction between IR degrees of freedom.

Presenter: LUZIO, Andrea (Università di Pisa)

TFI 2022: Theori ... / Report of Contributions

review talk - Gravitational Waves

Contribution ID: 6

Type: not specified

review talk - Gravitational Waves

Tuesday, 14 June 2022 09:15 (1 hour)

Presenter: DAMOUR, Thibault (IHES)

Eikonal exponentiation and gravit ...

Contribution ID: 7

Type: not specified

Eikonal exponentiation and gravitational waves

Tuesday, 14 June 2022 10:15 (35 minutes)

In this talk I will illustrate recent progress on the connection between scattering amplitudes and the classical emission of gravitational waves in black-hole scattering events. Focusing on the eikonal exponentiation, which provides a strategy to extract the classical limit, I will describe how amplitudes determine the classical deflection in the black-hole trajectories and the spectra of emitted energy and angular momentum. In particular, I will illustrate how soft theorems can be exploited to calculate efficiently the zero-frequency limit of such spectra, and the radiation backreaction on the black-hole motion.

Presenter: HEISSENBERG, Carlo (Uppsala)

Black hole perturbations from Lio ...

Contribution ID: 8

Type: not specified

Black hole perturbations from Liouville correlators

Tuesday, 14 June 2022 11:20 (35 minutes)

Reversing the logic of the bootstrap approach in Liouville CFT we explicitly compute the connection formulae for degenerate conformal blocks. In the semiclassical limit of the theory, this amounts to solving the connection problem of Fuchsian ODEs. Generalizing to irregular insertions we solve as well for various confluences of the ODE. Concentrating on the Heun equation and its confluences, we can solve the wave equations of a large class of gravitational backgrounds. In deed, when the wave equation of a black hole or a microstate is separable, it often reduces to Heun equations, and exact connection formulae give access to several interesting quantities. As a working example, we focus on the 4d Kerr black hole, and exactly compute the absorption coefficient, QNMs and Love numbers in terms of combinatorial objects exploiting the AGT duality.

Presenter: IOSSA, Cristoforo (SISSA - Trieste)

Type: not specified

Matched Asymptotic Expansion for Spinning Black Hole Magnetospheres

Tuesday, 14 June 2022 11:55 (35 minutes)

In 1977 Blandford & Znajek (BZ) initiated the analytic study of force-free magnetospheres by developing a perturbation scheme in the slow spin regime of a Kerr black hole, which lead to the discovery of a viable electromagnetic Penrose-like process for extracting energy and angular momentum. In this talk we solve the BZ perturbation theory at higher orders by means of a matched asymptotic expansion scheme and discover the unavoidable presence of non-analytic terms in the perturbative parameter entering the expressions for the energy extracted by the magnetosphere. These terms allows us to reach an unprecedented agreement with past numerical simulations up to the near-extreme regime and can potentially predict new features about the non-perturbative structure of the BZ theory, showing how the construction of analytic models still constitutes a powerful tool in this field.

Presenter: CAMILLONI, Filippo (Istituto Nazionale di Fisica Nucleare)

Type: not specified

Exact TTbar deformation of two-dimensional Yang-Mills theory

Tuesday, 14 June 2022 12:30 (35 minutes)

In this talk, I will discuss the TTbar deformation of Yang-Mills theory in two dimensions. Focusing on the sphere topology and unitary gauge groups, I will show how the deformed partition function can be obtained by solving the relevant flow equation at the level of individual flux sectors. For positive values of the deformation parameter, the quantum spectrum of the theory experiences a truncation, the partition function reducing to a sum over a finite set of energy levels. For negative values, the appearance of nonperturbative contributions drastically modifies the structure of the partition function regularising its naive divergences. In the large-N expansion, the theory exhibits a rich phase diagram where the transitions between different phases are driven by instantons both in the 't Hooft coupling (leading to a deformed Douglas-Kazakov phase transition) and in the deformation parameter.

Presenter: PAPALINI, Jacopo (Università di Parma)

Type: not specified

3d N=2 dualities for SQCD with D-type superpotential

Tuesday, 14 June 2022 14:30 (35 minutes)

In this talk I will discuss IR dualities for 3d supersymmetric QCD with

four supercharges and extra fields in tensorial representation of the

gauge group, giving rise to superpotential of D-type, where D refers to

the A-D-E classification. The prototypical example of such dualities was conjectured in the mid 90's for SU(N) SQCD with four supercharges and with two adjoints. Various generalizations, involving real gauge groups and other two-index tensor

representations, have been studied as well. In this talk I will show how these results extend to 3d, generalizing previous constructions discussed in the recent literature and unifying the webs of dualities found here with the ones already obtained for ordinary SQCD and for SQCD with one adjoint and an A-type superpotential. As a consistency check I will discuss a parallel analysis in terms of the three sphere partition function. I will conclude by discussing open problems and possible future directions.

Presenter: AMARITI, Antonio (Istituto Nazionale di Fisica Nucleare, Sezione di Milano)

Type: not specified

Exact results in a N=2 SCFT at strong coupling

Tuesday, 14 June 2022 15:05 (35 minutes)

We consider the N=2 SYM theory with gauge group SU(N) and a matter content consisting of one multiplet in the symmetric and one in the anti-symmetric representation of the gauge group. This theory is conformal and it admits a large-N 't Hoof t expansion and a gravity dual given by a particular orientifold of AdS_5 X S^5. We analyze this theory relying on

the matrix model provided by localization à la Pestun. Even if this matrix model has very nontrivial interactions, by exploiting the full Lie algebra approach to the matrix integration, we show that a large class of observables can be expressed in a closed form in terms of an infinite matrix depending on the 't Hooft coupling lambda. These exact expressions can be used to generate the perturbative expansions at high orders and also to analytically study the leading behavior at strong coupling.

Finally we compare these predictions to a direct Monte Carlo numerical evaluation of the matrix integral and to the Padé resummation derived from very long perturbative series. We also discuss the generalization of these results for a circular quiver gauge theory.

Presenter: PINI, Alessandro (Università di Torino)

Lower dimensional BPS sectors in ...

Contribution ID: 13

Type: not specified

Lower dimensional BPS sectors in 4d SU(N) N=4 SYM

Tuesday, 14 June 2022 16:10 (35 minutes)

I will explain how in the expansion near roots of unity, the four-dimensional superconformal index decomposes into a sum over independent sectors, some of them described by A-models wrapping Riemann surfaces. Starting from the four dimensional index the partition function of these lower dimensional systems is reduced to a sum over vacua of the specific A-model. The number of degrees of freedom is subleading in the large N expansion, and their contribution to the index, which seems to naturally organize as a sum over genus-g contributions, calls for a string dual interpretation.

Presenter: CABO-BIZET, Alejandro (King's College)

Type: not specified

Charting the space of 4d supersymmetric theories from string theory

Tuesday, 14 June 2022 16:45 (35 minutes)

Supersymmetric field theories represent an invaluable theoretical laboratory for the exploration of non-perturbative dynamics and their geometric realization in string theory has proven to be a very effective tool to understand them, allowing us to construct and study in detail the properties of strongly-coupled theories even when they lack a lagrangian description. In this talk I will present a new method to engineer four dimensional theories with eight supercharges from D3 branes probing non-perturbative Type IIB (F-theory) backgrounds. This allows us to construct many new N=2 theories, including N=3 models and all superconformal theories with one-dimensional Coulomb branch. Furthermore, by exploiting this construction we find a connection between these 4d theories and superconformal theories in six dimensions which proves crucial to understand their moduli space of vacua.

Presenter: GIACOMELLI, Simone (Università di Milano Bicocca)

TFI 2022: Theori ... / Report of Contributions

review talk - Towards Celestial Ho ...

Contribution ID: 15

Type: not specified

review talk - Towards Celestial Holography

Wednesday, 15 June 2022 09:30 (1 hour)

Presenter: DONNAY, Laura (TU - Wien)

New dualities from orientifold pro...

Contribution ID: 16

Type: not specified

New dualities from orientifold projections

Wednesday, 15 June 2022 10:30 (35 minutes)

The brane tiling machinery allows us to construct 4d SCFTs that represent the gauge side of the AdS/CFT correspondence. These theories arise from D3 branes probing a singular toric CY cone. One can add orientifold planes to the system, and the projected gauge theory can still be read from the brane tiling. One may expect that either the orientifold yields subleading correction to R-charges and conformal invariance is preserved at large N, or that the orientifold breaks scale invariance. In this talk, I will focus on the orientifold projection of the specific toric singularities denoted as L^{a} , and show that when conformal invariance is broken, a new fixed point arises in the infrared. Moreover, we show evidence for the new SCFT to be dual to the orientifold projection of a different toric geometry.

Presenter: MANCANI, Salvo (Roma Tor Vergata)

Type: not specified

Quantum Integrability in the ODE/IM Correspondence Approach for New Exact Results in N=2 Supersymmetric Gauge Theories and Black Holes' Observables

Wednesday, 15 June 2022 11:50 (35 minutes)

In this talk I will explain first of all a new connection we found between quantum integrable models and black holes' perturbation theory. To begin with, I will introduce black holes' quasinormal modes (QNMs) and their role in gravitational waves observations, showing in particular how to connect their mathematically precise definition with the integrable model's (IM) structures derived from the ordinary differential equation (ODE) associated to the black hole perturbation, in the approach of the ODE/IM correspondence. More precisely, I will derive the full system of functional and non linear integral equations (Thermodynamic Bethe Ansatz, TBA) typical of quantum integrability and prove that QNMs verify different equivalent exact quantization conditions. As a consequence, it follows a new simple and effective method to numerically compute the quasinormal modes - the TBA - which I will compare with other methods. I will also give a mathematical explanation of the recently found connection between quasinormal modes and N=2 supersymmetric gauge theories, through the further connection we previously found of these to quantum integrable models and which I will also briefly summarize. Moreover, I will swiftly tell how other black holes' observables like the greybody factor (or absorption coefficient, which accounts for Hawking radiation) could be tackled and computed through the same integrability methods. All this I will show for a generalization of extremal Reissner-Nordström (charged) black holes, but in the end I will explain how we think it should be possible to generalize it to many other (General Relativity or String Theory-) types of black holes, branes, fuzzballs, in either asymptotically flat or asymptotically AdS spacetime and thus provide a new effective tool for the study on one hand of supersymmetric gauge theories and on the other hand of gravitational waves and quantum gravity.

Based on:

1 D. Fioravanti, D. Gregori, arXiv:2112.11434 (2021)

2 D. Fioravanti, D. Gregori, arXiv:1908.08030, Phys.Lett.B 804, 135376 (2020)

3 D. Fioravanti, D. Gregori, H. Shu, to appear soon

Presenter: GREGORI, Daniele (Istituto Nazionale di Fisica Nucleare)

Orbifolds in spacetime

Contribution ID: 18

Type: not specified

Orbifolds in spacetime

Wednesday, 15 June 2022 12:25 (35 minutes)

Orbifolding in string theory is a standard procedure to get new theories from old ones either by gauging a global symmetry of the worldsheet sigma model or by quotienting a geometric string background by some isometries. The absence of global symmetries characterizes all known string theory models (and, conjecturally, all theories of quantum gravity), so that the orbifold procedure from a purely spacetime quantum field theoretic perspective is not fully understood. We illustrate a proposal for an orbifold procedure that does not rely on worldsheet techniques. We discuss some simple examples and possible consequences.

Presenter: GIACCARI, Stefano (Università di Padova)

Type: not specified

Topological and dynamical aspects of the Jacobi sigma model

Wednesday, 15 June 2022 13:00 (35 minutes)

The main features of the Jacobi sigma model will be illustrated. The Jacobi sigma model is a topological field theory with target space a Jacobi manifold, and it is a generalization of the Poisson sigma model. It is a non-linear gauge theory and it has interesting properties which can be useful for both physical and mathematical applications. In particular, contact as well as locally conformal symplectic manifolds will be considered as target spaces for the model, leading to interesting results for string backgrounds. A dynamical extension will be also discussed and applied for the SU(2) Lie group as a contact manifold, as it shows an interesting relation with Poisson-Lie T-duality.

Presenter: BASCONE, Francesco (Istituto Nazionale di Fisica Nucleare)

Novel exact results and new indice ...

Contribution ID: 21

Type: not specified

Novel exact results and new indices for supersymmetric theories in three dimensions

Tuesday, 14 June 2022 17:20 (35 minutes)

We discuss special subsectors of protected operators appearing in quantum field theories with extended supersymmetry defined on a general class of three-dimensional manifolds. Correlators of such BPS operators are generated by a one-dimensional Gaussian model obtained from localization and turn out to be topological as well as strongly dependent on the global features of the original 3-manifold. Furthermore, we show how extending localization techniques to backgrounds with orbifold singularities leads to novel types of supersymmetric indices, generalizing superconformal and topologically twisted indices. In particular, these new observables are relevant for the microstate counting of the recently constructed supersymmetric and accelerating black holes in four-dimensional Anti-de Sitter space-time.

Presenter: PITTELLI, Antonio (Università di Torino)

Weak gravity, supergravity, and de ...

Contribution ID: 22

Type: not specified

Weak gravity, supergravity, and de Sitter vacua

Monday, 13 June 2022 16:55 (35 minutes)

We review recent developments concerning the properties of de Sitter vacua of 4D supergravity. In particular, we analyze the consistency the de Sitter vacua within 4D gauged supergravity from the perspective of the swampland, focusing on the implications of the magnetic weak gravity conjecture, and we also briefly discuss recent developments related to anti-brane uplifts and non-linear supersymmetry.

Presenter: FARAKOS, Fotis (University of Padova)