New Frontiers in Theoretical Physics
XXXVI Convegno Nazionale di Fisica Teorica

Wednesday 23 May 2018 – Saturday 26 May 2018

Palazzone della Scuola Normale Superiore, Cortona (Arezzo)

Parallel Sessions – Talk list

Name	Title	Abstract
ACCETTULLI HUBER, Manuel Università di Padova	The natural structure of scattering amplitudes	A bottleneck of analytic calculations in high-energy physics is represented by the usually large size of intermediate expressions. In this talk I will present a technique which allows to bypass this issue, by reconstructing analytic results from numerical evaluations, where each intermediate step of the calculation is simply a natural number. This reconstruction procedure is suited for any polynomial or rational function, and I will present its application to tree-level scattering amplitudes.
ALDI, Giulio Francesco Università di Salerno	Gravitational lensing by black holes: theory and applications	Black holes represent the ideal laboratory to observe the deflection of light rays. We focus our attention on the photons that perform large deflection angles, winding several times around the black hole before reaching the observer. Here, we show the analytical resolution of the geodesic equations in the context of the strong deflection limit, in order to obtain the photons path in presence of a rotating black hole. Subsequently, we shall point out how the strongly deflected photons can affect the observables in some astrophysical applications.
ANSELMI, Damiano Università di Pisa	Fakeons, Lee-Wick models and quantum gravity	A consistent theory of quantum gravity is presented. It is built as a higher derivative theory, where the would-be ghosts are tuned into "fakeons" (i.e. fake degrees of freedom) by means of a new quantization prescription. The fakeons disentangle the real parts of the amplitudes from their imaginary parts, thereby making renormalizability compatible with unitarity. The theory is also unique. Calculations at one loop are presented to illustrate how the graviton/fakeon prescription works. A number of phenomenological predictions are addressed.
AZZOLA, Matteo Università di Milano	AdS_5 black strings in the stu model of FI-gauged N = 2 supergravity	We analytically construct asymptotically AdS_5 black string solutions starting from the four-dimensional domain wall black hole of [1]. It is shown that its uplift gives a black string in d = 5 minimal gauged supergravity, with momentum along the string. Applying instead the residual symmetries of N = 2, d = 4 Fayet-Iliopoulos-gauged supergravity discovered in [2] to the domain wall seed leads, after uplifting, to a dyonic black string that interpolates between AdS_5 and AdS_3 × H_2 at the horizon. A Kaluza-Klein reduction of the latter along an angular Killing direction ? followed by a duality transformation yields, after going back to five dimensions, a black string with both momentum along the string and rotation along ?. This is the first instance of using solution-generating techniques in gauged supergravity to add rotation to a given seed. These solutions all have constant scalar fields. As was shown in [3], the construction of supersymmetric static magnetic black strings in the FI-gauged stu model amounts to solving the SO(2,1) spinning top equations, which descend from an inhomogeneous version of the Nahm equations. We are able to solve these in a particular case, which leads to a generalization of the Maldacena-Nuñez solution.
BAIGUERA, Stefano Università di Milano-Bicocca	Volume and complexity for warped AdS black holes	In this talk I will review the complexity=volume conjecture proposed by Susskind. Then I will study this conjecture for Warped AdS black holes. I will compute the spatial volume of the Einstein-Rosen bridge finding that its growth rate is proportional to the Hawking temperature times the Bekenstein-Hawking entropy. This is consistent with expectations about computational complexity in the boundary theory.

BARTOLINI, Lorenzo Università di Pisa	From the Sakai-Sugimoto Model to the Generalized Skyrme Model	We derive the generalized Skyrme model as a low-energy effective model of the Sakai-Sugimoto model. The novelty with the past is the presence of the sextic term equal to the topological charge squared. This term appears when the ? meson, and the tower of states on top of it, are integrated out. The coefficients of the effective Skyrme Lagrangian are fixed by the top-down holographic approach, so they are determined by the few free parameters of the Sakai-Sugimoto model. We claim that, in the small 't Hooft coupling limit, the instanton is well described by a Skyrmion arising from the low energy effective Lagrangian of the Sakai-Sugimoto model. The sextic term plays a dominant role in this limit. Moreover, when a pion mass term is added, we recover the BPS Skyrme model in the small 't Hooft coupling limit.
BIANCHI, Lorenzo Queen Mary, University of London	Wilson lines as superconformal defects in N=2 theories	In this talk I will discuss the energy emitted by a moving particle in N=2 supersymmetric theories using a superconformal defect approach. In particular we will prove a theory independent relation between the one-point function of the stress tensor in the presence of a Wilson line and the two-point function of the displacement operator, commonly known as Bremsstrahlung function.
BONANNO, Claudio Università di Pisa	Topological properties of the CP^{N-1} models in the large-N limit	We provide a numerical determination of the theta-dependence of CP^{N-1} models up to (and including) O(theta^6) terms, for a range of N going from 9 to 31, and compare it to analytic predictions obtained in 1/N expansion. Contributions from O(theta^8) terms are also considered, however our present statistical accuracy permits us to set only upper bounds on them.
BONANSEA, Sara Università di Firenze	Holographic phase transition in N=4 defect theory	In the context of AdS/CFT correspondence, we study a D5-D3 system which is dual to a conformal field theory with a codimension-one defect (dCFT) inserted. On the gauge theory side, this interface connects two N = 4 super Yang-Mills theories with gauge group ranks that differ by k, meaning that k out of the N D3 branes get dissolved in the D5 brane. In this set-up, we consider a circular Wilson loop of radius R, placed on a plane parallel to the defect at a distance L from it. In the dual gravity description, the Wilson loop corresponds to the classical string extending from the boundary inside AdS5 ×S5 and its vacuum expectation value is computed by the area of the minimal surface. At large values of L/R, the Wilson loop is not affected by the interface and the string does not reach the D5 profile inside the bulk. As we get closer to the defect, we find a phase transition after which the string worldsheet attaches to the brane with suitable Neumann conditions. We analyze in detail the nature and the critical values of the parameters of this phase transition.
BONINI, Alfredo Università di Bologna	Planar N=4 Wilson loops/amplitudes and Integrability	In planar N=4 Super Yang-Mills the null polygonal Wilson loops and the 4d gluon scattering amplitudes are the same. The pentagon approach, a variant of the Operator Product Expansion applied to the polygonal Wilson loops, allows a non-perturbative evaluation of these observables by employing the underlying integrability of the theory. In this framework, we obtained some results in the strong coupling regime. According to the AdS/CFT duality, the classical AdS5 string result is reproduced by a resummation of the OPE series, giving the known TBA-like equations for the scattering amplitudes. The excitations responsible for that contribution are gluons and (anti)-fermions, where the latter form effective bound states in the strong coupling limit. The emergence of the TBA description shows many analogies with the Nekrasov-Shatashvili limit of the instanton partition function in N=2 theories. Besides the classical result, an additional correction of the same order emerge from the OPE series, due to the scalar excitations and described, on the string side, by the dynamics on S5. We analitycally proved this contribution, described by an O(6) correlator, by studying the short-distance limit of its form factor series. At any coupling, we studied the form factors of the twist operator appearing in the OPE series, with a particular

		focus to its matrix structure under the SU(4) R-symmetry. This coupling independend part is given by a multiple integral over the SU(4) spin chain auxiliary rapidities, reflecting the SU(4) Dynkin diagram. We computed these integrals and recast the result in a sum over rational functions, organizing the different residue contributions in a Young tableaux pattern.
CLEMENTE, Giuseppe Università di Pisa	Spectral Methods in Causal Dynamical Triangulations	I will discuss the application of spectral analysis, i.e. analysis of the spectrum and eigenvectors of the Laplace-Beltrami operator, in the setting of the Monte-Carlo approach to Quantum Gravity called Causal Dynamical Triangulation (CDT). In particular, we applied the method to the analysis of spatial slices, showing that the different phases can be characterized by a new order parameter related to the presence or absence of a gap in the spectrum of the Laplace-Beltrami operator, and deriving an effective dimensionality of the slices at the different scales.
CRIBIORI, Niccolò Università di Padova	New D-term and de Sitter vacua in supergravity	The interest in de Sitter vacua is clearly motivated from observations, nevertheless their construction from string theory still remains as an open problem. In this context, one of the most studied setup (KKLT) involves the introduction of anti D3 branes, after the stabilization of the moduli with fluxes and non perturbative effects. The anti branes in fact give a positive definite contribution to the vacuum energy and break supersymmetry spontaneously. In this talk I use supergravity as a consistent low energy description of string theory, in order to propose an effective theory which can describe the impact of the anti D3 branes on the scalar potential. The essential ingredient is a new embedding of the D-term in supergravity which, in contrast to the standard case, does not require the gauging of the R-symmetry.
DELLE ROSE, Luigi Università di Firenze	Supersymmetry versus Compositeness: 2HDMs tell the story	Supersymmetry and Compositeness are two prevalent paradigms providing both a solution to the hierarchy problem and a motivation for a light Higgs boson state. As the latter has now been found, its dynamics can hold the key to disentangle the two theories. An open door towards the solution is found in the context of 2-Higgs Doublet Models (2HDMs), which are necessary to Supersymmetry and natural within Compositeness in order to enable Electro-Weak Symmetry Breaking. We show how 2HDM spectra of masses and couplings accessible at the Large Hadron Collider may allow one to separate the two scenarios.
DIAMANTINI, Maria Cristina Università di Perugia	Confinement and asymptotic freedom with Cooper pairs	In particle physics the mechanism of confinement, that binds quarks into hadrons at `large' spatial scales but leaves them asymptotically free at subparticle distances is not thoroughly understood. The fundamental idea that confinement is mediated by the formation of (chromo)-electric strings in a condensate of magnetic monopoles, in a mirror analogue to vortex formation in type II superconductors, is widely accepted but still not sufficiently supported by direct experimental evidence. We have developed a topological gauge theory of the superconductor-to-insulator transition (SIT), and we have shown that the mirror image of superconductivity, the superinsulating state, a new topological state of matter characterised by an infinite resistance at finite temperatures, manifestly realizes the confinement phenomenon. In fact the mechanism of superinsulation is Polyakov's magnetic monopole condensation, resulting in the formation of electric strings and hence in linear confinement of Cooper pairs and in asymptotic freedom at small distances. This implies that systems of a size smaller than the string scale appear in a quantum metallic state. Accordingly, the SIT realizes the field-theoretical S-duality.

FERRERO, Pietro Scuola Normale Superiore Pisa	On the Lagrangian formulation of Gravity as a double-copy of two Yang-Mills theories	Many connections have been observed between gauge theories and gravity. In particular, new correspondences have been recently discovered, the so-called double copy relations, that extend the string-inspired KLT relations and allow to regard (super-)gravitational amplitudes as some sort of squares of (super-)Yang-Mills ones. We investigate the possibility of a Lagrangian formulation of the double-copy relations in the N=0 supergravity case, in which the gravitational theory also contains a two-form field and a dilaton. We exploit a definition of the fields in the gravity theory given by Duff et al. in order to build a quadratic Lagrangian, which is then extended at the cubic level by means of the Noether procedure. The goal is to arrive at a proposal for the gravitational vertices and for the corresponding non-linear gauge transformations in terms of their spin-one counterparts, and thus to ultimately provide a geometrical interpretation of the double-copy structures emerging in several contexts.
GALVAGNO, Francesco Università di Torino	Correlators in presence of Wilson loops in superconformal gauge theories	The high degree of symmetries of certain supersymmetric theories imposes strong constraints on physical quantities. We see how correlation functions in presence of a Wilson loop can be captured by a matrix model thanks to conformal symmetry and N=2 extended supersymmetry, then we perform some perturbative checks of this claim.
GARATTINI, Remo Università di Bergamo	Entropy for a Rotating Black Hole	We consider the effects of rotations on the calculation of some thermodynamical quantities like the free energy, internal energy and entropy. In ordinary gravity, when we evaluate the density of states of a scalar field close to a black hole horizon, we obtain a divergent result which can be kept under control with the helpof some standard regularization and renormalization processes. We show that when we use the Gravity's Rainbow approach such regularization/renormalization processes can be avoided. A comparison between the calculation done in an inertial frame and in a comoving frame is presented.
GORINI, Nicola Università di Padova	Twining Genera of K3	In this talk will be presented 2-dimensional N=(4,4) superconformal field theories and their application to superstring theories, in particular Non-Linear Sigma Models whose target space is a K3 surface.
GRIGUOLO, Luca Università di Parma	A new hat for the ABJM matrix model: exact computation of latitude Wilson loops	We propose a deformation of the ABJM matrix model that should compute the exact vacuum expectation values of latitude Wilson loop operators. Without Wilson loop insertions, it reproduces non-trivially the ABJM partition function, suggesting that it could be rigorously derived by supersymmetric localization using non-standard, latitude-dependent supercharges. We support our proposal by comparing successfully the Wilson loop evaluation both at weak coupling, using standard perturbation theory at three-loops, and at strong coupling, where explicit semiclassical string results are available.
HEISSENBERG, Carlo Scuola Normale Superiore Pisa	Higher-Spin Asymptotic Symmetries, Charges and Soft Theorems	Inspired by the link between asymptotic symmetries and soft theorems in four-dimensional gravity and QED, we study the large gauge transformations of massless fields with arbitrary integer spin, in any spacetime dimension. Upon imposing suitable falloff conditions, analogous to the asymptotic flatness conditions for gravitational systems, we calculate the associated asymptotic charges, the energy flux and, in the Yang-Mills case, the charge flux at null infinity. In four dimensions, our approach unveils an infinite-dimensional family of higher-spin asymptotic symmetries, whose Ward identities allow us to retrieve the corresponding Weinberg soft theorem.

JELIC, Asja ICTP	Propagation of information in turning flocks of starling	Animal groups on the move are a paradigmatic example of collective behavior in social species in which the tools of statistical physics can be fruitfully used. I will present an experimental and theoretical study of spontaneous rapid collective turns in natural flocks of starlings in which we find a sound-like propagation of the turning decision across the flock with no damping of information. This is in contrast with standard theories of collective animal behavior based on alignment, which predict a much slower, diffusive spread of information. We propose a novel theory for propagation of orientation in flocks whose key ingredient is the existence of a conserved spin current generated by the gauge symmetry of the system. Moreover, our analysis reveals that spontaneous collective turns are triggered by persistent localized fluctuations in the travel direction of some individuals in the flock. Two crucial ingredients which enhance the effect of such noise leading to collective changes of state are: the non-symmetric nature of interaction between individuals and the presence of heterogeneities in the topology of the network.
KORSMEIER, Michael Università di Torino	Production cross sections of cosmic antiprotons	The cosmic-ray flux of antiprotons is measured with unprecedented accuracy by the space-borne particle spectrometers AMS-02. Its interpretation requires a correct description of the dominant production process for antiprotons in our Galaxy, namely, the interaction of cosmic-ray proton and helium with the interstellar medium. In the light of new cross section measurements by the NA61 experiment of p + p ->\bar{p} + X and the first ever measurement of p + He -> \bar{p} + X by the LHCb experiment, we update the parametrization of proton-proton and proton-nucleon cross sections. We find that the LHCb p He data constrain a shape for the cross section at high energies and show for the first time how well the rescaling from the pp channel applies to a helium target. By using pp, p He and p C data we estimate the uncertainty on the Lorentz invariant cross section for all relevant antiproton production channels in the Galaxy. We use these new cross sections to compute the antiproton source terms. The uncertainties on the total source term is at the level of 20% and slightly increase below antiproton energies of 5 GeV. Since this exceeds the uncertainties on the antiproton flux which is measured by AMS-02 at an accuracy of 5% in an energy range from 1 to 400 GeV, we finally quantify the necessity of new data on antiproton production cross sections, and pin down the kinematic parameter space which should be covered by future experiments.
LANZA, Stefano Università di Padova	Three-forms: from Supergravity To Flux Compactifications	In four dimensions gauge three-forms do not carry any propagating degrees of freedom, but they can induce nontrivial physical effects. They may dynamically generate an effective potential for the scalar fields by promoting specific coupling constants appearing in the superpotential to expectation values of their field strengths. Moreover, they naturally allow for the coupling of supergravity to membranes, which give rise to a pletora of effective theories with different potentials, along with new domain wall solutions interpolating among the vacua on the two sides. The four dimensional supergravity coupled to membranes provides an effective description of type II string theory compactified on Calabi-Yau three-folds with orientifold, with membranes originating from D-branes wrapped on extra internal dimensions.
LUCIANO, Gaetano Università di Salerno,	Modified Unruh effect from Generalized Uncertainty Principle	We consider a generalized uncertainty principle (GUP) corresponding to a deformation of the fundamental commutator obtained by adding a term quadratic in the momentum. From this GUP, we compute corrections to the Unruh effect and related Unruh temperature, by first following a heuristic derivation, and then a more standard field theoretic calculation. In the limit of small deformations, we recover the thermal character of the Unruh radiation. Corrections to the temperature at first order in the deforming parameter are compared for the two approaches, and found to be in agreement as for the dependence on the cubic power of the acceleration of the reference frame. The dependence of the shifted temperature on the frequency is also pointed out and discussed.

MARZOLLA, Andrea Università di Firenze	Poincaré shapes the 3-point scattering amplitude for any masses and spins. And BMS?	In the work arXiv:1601.08113 we used the spinor-helicity formalism for massive momenta to implement the constraints imposed by Poincaré invariance on three-point amplitudes, and derive the most general kinematic form for arbitrary masses and spins. We review the derivation, based on the Little Group scaling of the amplitude, and project and speculate towards the possibility of adopting the same methods to impose constraints from asymptotic symmetries.
MASSAI, Stefano University of Chicago	Black hole microstates in string theory	In string theory, black hole microstates at finite coupling give rise to horizon-scale structures that play an important role in addressing the information paradox. These are based on configurations of branes puffed up by the supertube effect. I will show that fully back-reacted supertubes admit an exact treatment in worldsheet string theory as gauged WZW models. These constructions reveal stringy structures that support precursors of the long strings which hold most of the entropy in the dual CFT.
MERLANO, Alberto Università di Torino	Localization of effective actions in Open Superstring Field Theory	We consider the construction of the algebraic part of D-branes tree-level effective action from Berkovits open superstring field theory. Applying this construction to the quartic potential of massless fields carrying a specific worldsheet charge, we show that the full contribution to the potential localizes at the boundary of moduli space, reducing to elementary two-point functions. Some examples of this general mechanism are presented.
MITRIDATE, Andrea Scuola Normale Superiore, Pisa	Bounds on the Dark Matter lifetime from Cosmic Dawn	The observation of the cosmic 21-cm spectrum can serve as a probe for Dark Matter properties. We point out that the knowledge of the signal amplitude at a given redshift allows one to put conservative bounds on the DM decay rate which are independent of astrophysical parameters. Using the experimental results reported by the EDGES collaboration, we derive bounds that are stronger than the ones derived from other CMB observations and competitive with the ones from indirect detection.
NADA, Alessandro DESY	The SU(3) equation of state with non-equilibrium methods	In non-equilibrium statistical mechanics Jarzynski's equality provides an elegant and powerful tool to compute directly differences in free-energy for stochastic processes, and in particular in Monte Carlo simulations. In this talk we show how it can be readily extended to lattice gauge theories for a large set of physically interesting observables. A novel technique to determine the thermodynamics of strongly-interacting matter based on this relation will be discussed. It allows for a direct and efficient determination of the pressure using out-of-equilibrium Monte Carlo simulations on the lattice. Results for the equation of state of the SU(3) Yang-Mills theory obtained with this technique in the confined and deconfined phases will be presented.
OLIVUCCI, Enrico Universität Hamburg	Integrability of Fishnet QFT in any dimension	I will talk about any-D generalization of the Fishnet QFT, which we recently obtained in a work with Vladimir Kazakov. The Fishnet theory by itself arises in the context of AdS/CFT correspondence as a strongly-deformed N=4 SYM and appear to be integrable in the spin chain formalism. The continuation to any dimension D is realized preserving both integrability and conformality at specific RG fixed points. We compute the exact 4-point function and conformal data of its OPE expansion. Also, we show how this theory interpolates between known models, such as 2D BFKL model of high energy gluon scattering and a 1D ?scalar version? of cSYK theory, up to an interesting D=? limit. Finally, we briefly sketch how one could generalize these results to any Zamolodchikov's integrable lattice, focusing on strongly deformed N= 6 ABJM.

PARISI, Matteo University of Oxford	Amplituhedron meets Jeffrey-Kirwan Residue	The Amplituhedra are mathematical objects generalising the notion of polytopes into the Grassmannian. Proposed as a geometric construction encoding scattering amplitudes in planar N=4 super Yang-Mills theory, they are in themselves mathematically interesting. In this paper we strengthen the relation between scattering amplitudes and geometry by linking the amplituhedron to the Jeffrey-Kirwan residue, a powerful concept in symplectic and algebraic geometry. We focus on a particular class of amplituhedra in any dimension, namely cyclic polytopes, and their even-dimensional conjugates. We show how the Jeffrey-Kirwan residue prescription allows to extract the correct amplituhedron volume functions in all these cases. Notably, this also naturally exposes the rich combinatorial and geometric structures of amplituhedra, such as their regular triangulations.
PETRUZZIELLO, Luciano Università di Salerno	On the role of neutrino mixing in accelerated proton decay	The inverse beta decay of accelerated protons has been analyzed both in the laboratory frame (where the proton is accelerated) and in the comoving frame (where the proton is at rest and interacts with a thermal bath of electrons and neutrinos). The equality between the two rates has been exhibited as a "theoretical check" of the necessity of Fulling-Davies-Unruh effect. Recently, it has been argued that neutrino mixing can spoil this agreement, potentially opening new scenarios in neutrino physics. In this talk, I analyze in detail this problem in order to understand the origin of such an ambiguity. A number of possible solutions is finally proposed.
PIVA, Marco Università di Pisa	The ultraviolet behavior of quantum gravity with fakeons	In this talk I will expose the features of a new local higher-derivative theory of quantum gravity. The model is based on the concept of fakeons or fake degrees of freedom, which solves the problem of ghosts and leads to a unitary, renormalizable theory. In particular, I will discuss its ultraviolet behavior at one-loop (including finite terms) in the case of vanishing cosmological constant, pointing out the physical difference of this theory with respect to Einstein gravity. Finally, the case of nonvanishing cosmological constant will be addressed.
PODO, Alessandro Scuola Normale Superiore Pisa	Dark Matter from adjoint fermions	Strongly interacting dark sectors with accidentally stable particles can offer an attractive scenario for explaining the observed dark matter abundance. I will consider theories with fermions in the adjoint representation of the dark gauge group and charged under the Standard Model. In this case, the candidate is an accidentally stable bound state of a gluon and a fermion, with peculiar properties and a rich cosmological history. A few models emerge as viable and I will outline their interesting phenomenological prospects.
POGGI, Matteo SISSA Triste	Elliptic non-Abelian DT invariants	We will discuss the system of N D7 branes wrapped on C^3 and k D1 branes on the D7. Then the effective dynamics of the D1 branes is described by a two-dimensional N=(2,2) GLSM. We explain our computation of the elliptic genus of the corresponding quiver gauge theory with the technique of Jeffrey-Kirwan residue. We also discus the D0/D6 and D(-1)/D5 dimensional reduction of the system and the relations among them. Finally a free-field interpretation of the elliptic genus is given.
PRETI, Michelangelo Ecole Normale Supérieure Paris	Strongly deformed N=4 SYM in the double scaling limit as an integrable CFT	The Fishnet theory arises in the context of AdS/CFT correspondence as a strongly-deformed N=4 SYM and appear to be integrable in the spin chain formalism. We study that theory in the double scaling limit of large imaginary twists and small coupling. This limit discards the gauge fields and retains only certain Yukawa and scalar interactions with three arbitrary effective couplings. We demonstrate by explicit multi-loop calculation that the double-scaled theory has nontrivial fixed points in which the theory is described by an integrable non-

		unitary four-dimensional CFT. We find a closed expression for the four-point correlation function of the simplest protected operators and use it to compute the exact conformal data of operators. This result suggests that both conformal symmetry and integrability should survive in strongly-deformed planar N=4 SYM for arbitrary values of the deformation parameters.
RAVERA, Lucrezia INFN Milano	Hidden Symmetries of Supersymmetric Free Differential Algebras	Supergravity theories in D?4 space-time dimensions contain gauge potentials described by p-forms, of various p>1, associated to p-index antisymmetric tensors. They are therefore appropriately discussed in the context of Free Differential Algebras (FDAs): An extension of the Maurer-Cartan equations to involve higher-degree differential forms. I will present an investigation of the gauge algebra hidden in all FDAs in supersymmetric theories, focusing, in particular, on the hidden symmetries of D=11 supergravity and on the physical role of the nilpotent fermionic generators naturally appearing in the hidden superalgebra underlying the theory. The approach adopted in this context could be an appropriate framework to discuss theories defined in enlarged versions of superspace, such as Exceptional Field Theory.
SAFARI, Mahmoud Università di Bologna	Renormalization group and epsilon expansion for multicritical box^k scalar theories	We employ perturbative RG in the functional form along with epsilon-expansion to study multicritical single scalar field theories with higher derivative kinetic terms. Depending on the upper critical dimension and the number of derivatives in the kinetic term we distinguish two types of theories which demonstrate qualitatively different features. We study the flow equations and critical properties of each type of models in turn. We show that while the first class of models is qualitatively similar to theories with standard kinetic term and admit a generalized Wilson-Fisher fixed point, in theories of the second type derivative interactions are unavoidable at the critical point and novel phase structures emerge.
SALVATORI, Giulio Università di Milano	Hyperbolic Geometry and Amplituhedra in 1+2 dimensions	Recently, the existence of an Amplituhedron for tree level amplitudes in the bi-adjoint scalar field theory has been proved by Arkhani-Hamed et al. We argue that hyperbolic geometry constitutes a natural framework to address the study of positive geometries in moduli spaces of Riemann surfaces, and thus to try to extend this achievement beyond tree level. In this paper we begin an exploration of these ideas starting from the simplest example of hyperbolic geometry, the hyperbolic plane. The hyperboloid model naturally guides us to re-discover the moduli space Associahedron, and a new version of its kinematical avatar. As a by-product we obtain a solution to the scattering equations which can be interpreted as a special case of the two well known solutions in terms of spinor-helicity formalism. The construction is done in 1+2 dimensions and this makes harder to understand how to extract the amplitude from the dlog of the space time Associahedron. Nevertheless, we continue the investigation accommodating a loop momentum in the picture. By doing this we are led to another polytope called Halohedron, which was already known to mathematicians. We argue that the Halohedron fulfils many criteria that make it plausible to be understood as a 1-loop Amplituhedron for the cubic theory. Furthermore, the hyperboloid model again allows to understand that a kinematical version of the Halohedron exists and is related to the one living in moduli space by a simple generalisation of the tree level map.
SGARLATA, Francesco SISSA Trieste	Beyond Positivity Bounds in EFTs	Analiticity, unitarity and crossing symmetry of scattering amplitudes have been shown to provide constraints on Effective Field Theories' (EFT) Wilson coefficients.cIn this talk we will show how dispersion relations can be used to go beyond the familiar positivity bounds within the EFT validity regime. This procedure turns out to provide very strong constraints on the maximal cut-off of the theory and we will discuss the impact of these bounds on the ghost-free

		massive gravity (dRGT). We will show that the combination of the resulting theoretical bound with the experimental constraint on the graviton mass implies dRGT massive gravity is ruled out.
SMALDONE, Luca Università di Salerno	Dynamical generation of fermion mixing	A careful non perturbative study of flavor mixing reveals an interesting structure of the flavor vacuum. This is deeply related to the existence of unitarily inequivalent representations of field algebra in Quantum Field Theory. Far from being a mathematical curiosity, this study leads to phenomenological corrections to the neutrino oscillations formula. The particle-antiparticle condensate structure of the flavor vacuum suggests the idea of fermion mixing as an emergent dynamical phenomenon. A non-perturbative model-independent analysis can be elaborated at algebraic level, where Nambu-Goldstone modes are studied via Ward-Takahashi identities. A particular case, by using operator formalism, was studied, where gap equations were obtained both for the masses and mixing angles. If we try to derive these sets of gap equations by using one-loop effective action with the help of path integral techniques, two immediate questions arise: i) Does path integral know about inequivalent representations? ii) Is it the standard generating functional of Green's functions capable of distinguishing among different inequivalent vacua?
SPADA, Gabriele SISSA Trieste	\phi^4 at NNNNNNNNLO	Perturbation theory of a large class of scalar field theories in d=4 can be shown to be Borel resummable using arguments based on Lefschetz thimbles. I will consider the two-dimensional \phi^4 theory and show how the behavior of the theory at strong coupling can be recovered successfully using known resummation techniques.
TARTAGLINO-MAZZUCCHELLI, Gabriele KU Leuven	Curvature squared invariants in 6D N=(1,0) supergravity	I will review the recent construction of new curvature squared supersymmetric invariants for off-shell N=(1,0) supergravity in six dimensions. This includes the Gauss-Bonnet invariant which is linked to the description of alpha'-corrections to the low-energy limit of compactified string theory.
TITOV, Arsenii Durham University	Viability of A_4, S_4 and A_5 Lepton Flavour Symmetries	We consider the A_4, S_4 and A_5 discrete lepton flavour symmetries in the case of 3-neutrino mixing, broken down to non-trivial residual symmetries in the charged lepton and neutrino sectors in such a way that at least one of them is a Z_2. Such symmetry breaking patterns lead to predictions for some of the three neutrino mixing angles and/or the leptonic Dirac CP-violating phase δ of the neutrino mixing matrix. We assess the viability of these predictions by performing a statistical analysis which uses as an input the latest global data on the neutrino mixing parameters. We find 14 phenomenologically viable cases providing distinct predictions for some of the mixing angles and/or the Dirac phase δ. Employing the current best fit values of the three neutrino mixing angles, we perform a statistical analysis of these cases taking into account the prospective uncertainties in the determination of the mixing angles, planned to be achieved in currently running (Daya Bay) and future (JUNO, T2HK, DUNE) neutrino oscillation experiments. We find that only six cases would be compatible with these prospective data. We show that this number is likely to be further reduced by a precision measurement of δ.
TROMBETTA, Leonardo Scuola Normale Superiore Pisa	Consistent models of Dark Energy after GW170817 and GRB170817A	The measurement of the speed of Gravitational Waves has imposed tight constrains on models of DE. One important question is to identify among the surviving theories, those that are stable under quantum corrections. We find the most general class of theories that are protected from large quantum corrections while still being phenomenologically interesting.