Talks

Albareti, Franco D.

Title: *The Higgs VEV with gravity*

Abstract: In this talk, I will present the scalar 1-loop corrections to the Higgs effective potential in a slowly-varying weak gravitational field. These corrections are finite and do not require further renormalization, i.e. the UV behaviour is the same as in flat spacetime. The computed effective potential with gravitational contributions implies an inhomogeneous Higgs vacuum expectation value and this translates into direct observational probes in the Solar System, e.g. variations on the proton-to-electron mass ratio.

Bielleman, Sjoerd

Title: *3 forms in flux compactifications*

Abstract: We discuss the role of Minkowski 3-forms in flux string vacua. In these vacua all internal closed string fluxes are in one to one correspondence with quantized Minkowski 4-forms. By performing a dimensional reduction of the $D = 10$ Type II supergravity actions we find that the 4-forms act as auxiliary fields of the Kahler and complex structure moduli in the effective action. We show that all the RR and NS axion dependence of the flux scalar potential appears through the said 4-forms. Gauge invariance of these forms then severely restricts the structure of the axion scalar potentials. Combined with duality symmetries it suggests that all perturbative corrections to the leading axion scalar potential V_0 should appear as an expansion in powers of V_0 itself. These facts could have an important effect e.g. on the inflaton models based on F-term axion monodromy. We also suggest that the involved multi-branched structure of string vacua provides for a new way to maintain interacting scalar masses stable against perturbative corrections.

Carta, Federico

Title: *Yukawa's couplings from the E7 point in F-theory*

Abstract:We present a recent work in which the SM Yukawa couplings for the two heaviest families are predicted from an ultralocal F-Theoretical framework. The top-bottom mixing angle in the CKM matrix is predicted as well.

Cebola, Luis

Title: *Anomaly-free Chiral Fermion Sets and Gauge Coupling Unification*

Abstract: We look for minimal chiral sets of fermions beyond the standard model that are anomaly free and, simultaneously, vector-like particles with respect to color and electric charge. It is studied whether the addition of such particles to the standard model particle content allows for the unification of gauge couplings at a high energy scale. Inspired in grand unified theories, we also search for minimal chiral fermion sets that belong to SU(5) multiplets, restricted to representations up to dimension 50. It is shown that, in various cases, it is possible to achieve gauge unification provided that some of the extra fermions decouple at relatively high intermediate scales.

Conroy, Aindriu

Title: *Geodesic Completeness and Non-Local Theories of Gravity*

Abstract: The Raychaudhuri Equation (RE) is employed in a non-local theory of gravity in order to illuminate the conditions under which such a spactime may avoid a cosmological singularity. An argument is presented whereby any modified theory may be tested in this way, without introducing ghosts or other infirmities into the system. The importance of the Raychaudhuri Equation regarding singularity theorems in General Relativity is discussed, before analysing the nature of null geodesic completeness around $t \to 0$ in a non-local bouncing cosmology, without violating the null energy condition. Further details are illustrated by conformal diagrams

Coone, Dries

Title: *Generic predictions of plateau inflation*

Abstract: In the absence of CMB precision measurements, a Taylor expansion has often been invoked for the inflaton scalar potential and therefore also for the Hubble function. However, the Planck results indicate a strong preference for plateau inflation, it therefore appears natural to consider Pade approximants. In this talk we will propose a numerical method for scanning such approximants and compare the results with data. Remarkably, these models are in excellent agreement with Planck.

Escudero, Miguel

Title: *The present and future of the most favoured inflationary models after Planck 2015*

Abstract: The value of the tensor-to-scalar ratio r in the region allowed by the latest Planck 2015 measurements can be associated to a large variety of inflationary models. I will discuss here the potential of future cosmological observations, using both the Cosmic Microwave Background and the Large Scale Structure of the universe, in disentangling among the possible theoretical scenarios. I will pay special attention to the limitations on future CMB missions when dealing with cosmological parameter extraction: the foregrounds. Rather than focusing on r, our work focus on the running of the primordial power spectrum, αs and the running of thereof, βs. The Fisher analyses show that future cosmological probes may be able to reach an unprecedented accuracy in the extraction of both α and β and either confirm or rule out the most favoured inflationary models.

Ecker, Christian

Title: *Entaglement entropy in shock wave collisions*

Abstract: Entanglement entropy, a measure for entanglement in quantum systems, attracts a lot of attention in seemingly unrelated branches of physics like quantum information, condensed matter and conformal field theories. While computing entanglement entropy in quantum field theories turns out to be notoriously hard, the holographic principle maps the problem to the much easier task of finding minimal (hyper)surfaces in a higher dimensional gravity theory. In this talk I will present our recent numerical relativity computations of entanglement entropy using a system of colliding gravitational shock waves as holographic toy model for the early stage of heavy ion collisions.

Fontanella, Andrea

Title: *Black Hole Horizons*

Abstract: It is well established that in dimensions more than four there are no generic black hole uniqueness theorems. However finding higher dimensional black hole solutions with exotic horizon topology is difficult, so most of the investigations have focused on the study of near-horizon geometries. Additionally, this investigation may turn useful to propose new AdS/CFT dualities. In this talk we will focus on extremal black hole horizons in heterotic supergravity, including corrections at first order in α'. Using a perturbation approach, we will show how to classify the near-horizon geometries.

Klein, Remko

Title: *Galileons as the scalar analogue of general relativity*

Abstract: In this talk I will establish a correspondence between general relativity (metric theories with diffeomorphism invariance) and scalar field theories with Galilean invariance: notions as the Levi-Civita connection and the Riemann tensor turn out to have a Galilean counterpart. Moreover, I will show that the requirement of a first-order Palatini formalism uniquely determines the Galileon models with second-order field equations, similar to the Lovelock gravity theories.

Korpas, George

Title: *Instantons on toric varieties*

Abstract: Nekrasov's partition function has been proven a strong analytical tool in order to calculate the partition function of twisted N=2 SYM theories in various backgrounds. In this talk we will give a brief overview of this machinery (topological twist, localization, instanton calculus) and see how we can use it in order to get exact results of N=2 SYM on toric varieties for gauge groups that allow a non-vanishing first Chern class. We will also see how these results are related to Donaldson invariants.

Landete, Aitor

Title: *D6-branes and axion monodromy inflation*

Abstract: We propose new large field inflation scenarios built on the framework of F-term axion monodromy. Our setup is based on string compactifications where D6-branes create different inflationary scenarios, where the potentials arise from closed string axions or open string moduli via F-terms. Because the source of the axion potential is different from the standard sources of moduli stabilisation, it is possible to lower the inflaton mass as compared to other massive scalars. We discuss a particular class of models based on type IIA flux compactifications with D6-branes. In the small field regime they describe supergravity models of quadratic chaotic inflation with a stabiliser field. In the large field regime the inflaton potential displays a flattening effect due to Planck suppressed corrections, allowing to easily fit the cosmological parameters of the model within current experimental bounds.

Liuzzo, Pietro

Title: *Gaussian interferometric power as a measure of continuous variable non-Markovianity*

Abstract: We investigate the non-Markovianity of continuous variable Gaussian quantum channels through the evolution of an operational metrological quantifier, namely the Gaussian interferometric power, which captures the minimal precision that can be achieved using bipartite Gaussian probes in a black-box phase estimation setup, where the phase shift generator is a priori unknown. We observe that the monotonicity of the Gaussian interferometric power under the action of local Gaussian quantum channels on the ancillary arm of the bipartite probes is a natural indicator of Markovian dynamics; consequently, its breakdown for specific maps can be used to construct a witness and an effective quantifier of non-Markovianity. In our work, we consider two paradigmatic Gaussian models, the damping master equation and the quantum Brownian motion, and identify analytically and numerically the parameter regimes that give rise to non-Markovian dynamics. We then quantify the degree of non-Markovianity of the channels in terms of Gaussian interferometric power, showing in particular that even nonentangled probes can be useful to witness non-Markovianity. This establishes an interesting link between the dynamics of bipartite continuous variable open systems and their potential for optical interferometry. The results are an important supplement to the recent research on characterization of non-Markovianity in continuous variable systems.

Montero, Jesus

Title: *New AdS_4 and AdS_3/CFT duals through Non-Abelian T-duality*

Abstract:We find a new N=2 AdS_4 solution in M-theory supported by purely magnetic flux via a sequence of Abelian and non-Abelian T-dualities. This provides the second known example in this class besides the uplift of the Pernici and Sezgin solution to 7d gauged supergravity constructed in the 80s. Even though the natural holographic interpretation is in terms of M5-branes wrapped on a special Lagrangian 3-cycle, the free energy of this solution does not exhibit the expected N^3 behavior. On the other hand, the non-Abelian T-dual of $AdS_3 \times S^3 \times S^3 \times S^1$ results in a new supersymmetric $AdS_3 \times S^2$ geometry, which falls outside of all known classifications. We explore the basic properties of its holographic dual and compute the central charge, which is compatible with a large N=4 superconformal algebra in the infra-red.

Morales, Roberto

Title: *Study of h,H,A $\to \tau, \mu$ decays in the context of the MSSM within the Mass Insertion Approximation*

Abstract: In this talk, we will discuss lepton flavor violating decay channels of the neutral Higgs bosons of the Minimal Supersymmetric Standard Model into a lepton and an anti-lepton of different flavor. Our analytical computation is based on the Mass Insertion Approximation (MIA) which uses the electroweak interaction slepton basis and treats perturbatively the mass insertions changing slepton flavor. Our aim is to provide a set of simple analytical formulas for the form factors and the associated effective vertices, that we think may be very useful for future phenomenological studies of the lepton flavor violating Higgs boson decays, and for their comparison with data. In this sense, the most optimistic numerical estimates for the Higgs decays channels into tau and mu leptons, searching for their maximum rates that are allowed by present constraints from $\tau \to \mu, \gamma$ data and beyond Standard Model Higgs boson searches at the LHC, will be shown as well.

Ntokos, Praxitelis

Title: *Generalized geometric vacua with 8 supercharges*

Abstract: Exceptional Generalized Geometry (EGG) is an extension of standard differential geometry such that the U-duality symmetry of string/M theory becomes manifest. It is a step further than Generalized Complex Geometry which geometrizes T-duality. In this work, we aim to write the supersymmetry conditions for compactifications preserving 8 supercharges in a U-duality covariant way. We focus on type IIB compactifications down to five dimensions. We prove that supersymmetry requires integrability conditions on some generalized structures, generalizing the Calabi-Yau conditions (closure of the Kähler and the holomorphic form). We comment on concrete applications (work in progress) in AdS/CFT.

Núñez, Santos

Title: *Isotropy theorem of oscillating cosmological fields*

Abstract:The ubiquity of scalar fields in cosmology is not only owed to its simplicity, but mainly because it intrinsically respects the large degree of isotropy observed in the universe. On the contrary, the evolution of a coherent vector field is clearly anisotropic. However, there have been various proposals in order to deal with the isotropy constraints: particular solutions that makes the energy-momentum tensor isotropic like triads of orthogonal vectors, a large number of randomly oriented fields, average isotropy of fast oscillating linearly polarized vector fields. Using a generalization of the virial theorem the last proposal can be extended to abelian and non-abelian theories for an arbitrary potential and polarization.

Finally, we will show that the average isotropy property is spin independent, given that the field oscillates fast enough.

Pini, Alessandro

Title: *Gauge invariants and Hilbert series*

Abstract: In this talk I would like to give an introduction to the topic of Hilbert series computation and the classification of gauge invariant quantities in a QFT.
I will review very briefly the notion of gauge invariant observable in a known QFT like QCD, finding two different types of observables: the mesons and the baryons. Then I will consider the general problem of classifying these quantities in a generic supersymmetric QFT with superpotential W and I will also introduce the further role played by the relations (the F-terms of the superpotential). I will discuss explicitly the case of N=4 SYM in 4d and the case of the conifold (where appear no-trivial relations). Using these examples, I will Introduce the notion of Hilbert Series, illustrating how this quantity can summarize the information related with the gauge invariant operators. I will discuss the general forms that can be assumed by the Hilbert series (complete intersection and not complete intersection) and its geometric interpretation. Finally, if there is still time, I will mention some applications of the Hilbert series in string theory related to the moduli space of instantons and quiver gauge theories

Pozas, Alejandro

Title: *Harvesting correlations from the vacuum*

Abstract: It is well-known that the vacuum state of a free quantum field contains entanglement between time- and spacelike-separated regions, and furthermore that this entanglement can be extracted to Unruh-DeWitt particle detectors that couple to the field locally, even when the detectors are spacelike-separated. This phenomenon is called entanglement harvesting, and it has found a full spectrum of applications ranging from proposals of quantum seismographs to probing the nature of spacetime.

In this talk I will outline my work on the harvesting not only of entanglement, but also of classical correlations present in the vacuum, with special emphasis on the case when the detectors are spacelike-separated. In particular, I will show the crucial role that factors like the dimensionality of spacetime, the energy structure of the detectors and most importantly the way in which the detectors couple to the field have in our ability to harvest correlations.

Rordiguez, David

Title: *Ward identities and relations between conductivities and viscosities in holography*

Abstract: We derive relations between viscosities and momentum conductivity in 2+1 dimensions by finding a generalization of holographic Ward identities for the energy-momentum tensor. The generalization is novel in the sense that it goes beyond the usual identities obtained from holographic renormalization. The main tools we use are a constant 'probability current' in the gravity dual, that we are able to define for any system of linear ODEs, and parity symmetry. We comment on the possible application of the probability current in the computation of the spectrum of normalizable modes.

Sarkar, Debajyoti

Title: *Locality in AdS and Firewalls for AdS black holes*

Abstract: The study of local physics in a theory of quantum gravity is an important problem. Here we discuss the recent developments on this topic at the supergravity limit and in particular describe how to extend this program for fields in dS and black hole backgrounds. Local field construction is also made at arbitrary cut-off surfaces in (A)dS and their connections to holographic RG are explored. Finally we argue about various finite N scenarios and their effects on bulk locality and black hole information paradox. Based on Arxiv: 1204.0126, 1408.0415, 1411.4657, 1502.03129 and 1505.03895.

Sundell, Peter

Title: *Beyond the Cosmological Principle*

Abstract: The era of precision cosmology is upon us and it is crucially important to understand all the possible phenomena affecting the observed data. This includes the effects of inhomogeneities and anisotropies beyond the perturbation theory.

Inhomogeneities offer an alternative to the dark energy explaining the apparent acceleration. The simplest of these models are ruled out by the incapability of explaining multiple data simultaneously, but the next generation inhomogeneous models offer new possibilities.

There are both parity preserving and violating anomalies observed of the CMB. The ΛCDM model can not explain the anomalies as such, but require at least small alteration. If we assume the Cosmological Principle breaks down at this accuracy and allows us to introduce anisotropy, we get shear and vorticity (which can explain the anomalies) in to the picture. Indeed, altering the concordance cosmological model only so that the dark fluid (energy or matter or combination) is not comoving with the ordinary matter and is rotating may induce the anomalies.

Sybesma, Watse

Title: *Lifshitz quasinormal modes and relaxation from holography*

Abstract: For the applications of holography to real world systems it is important to investigate a generalization to non-relativistic field theories. An example of a non-relativistic field theory is one that exhibits Lifshitz scaling, in which the dynamical exponent z governs the "amount" of anisotropy between space and time. In this talk I present the results of studying the relaxation time for field theories with Lifshitz scaling and with holographic duals Einstein-Maxwell-Dilaton gravity theories, using quasinormal modes in the gravitational bulk. It turns out that there exists a peculiar relation between relaxation time and dynamical exponent z, for various values of boundary dimension and operator scaling dimension. This talk is based on publication 1503.07457.

Talaganis, Spyridon

Title: *Towards understanding the ultraviolet behavior of quantum loops in infinite-derivative theories of gravity*

Abstract: In this talk I will consider quantum aspects of a non-local, infinite-derivative scalar field theory - a *toy model* depiction of a covariant infinite-derivative, non-local extension of Einstein's general relativity which has previously been shown to be free from ghosts around the Minkowski background. The graviton propagator in this theory gets an exponential suppression making it *asymptotically free*, thus providing strong prospects of resolving various classical and quantum divergences. In particular, I will find that at 1-loop, the 2-point function is still divergent, but once this amplitude is renormalized by adding appropriate counter terms, the ultraviolet (UV) behavior of all other 1-loop diagrams as well as the 2-loop, 2-point function remains well under control. I will go on to discuss how one may be able to generalize our computations and arguments to arbitrary loops.

Teimouri, Ali

Title: *Wald Entropy for Ghost-Free, Infinite Derivative Theories of Gravity*

Abstract: We demonstrate that the Wald entropy for any spherically symmetric black hole within an infinite derivative theory of gravity that is quadratic in curvature is determined solely by the area law. Thus, the infrared behavior of gravity is captured by the Einstein-Hilbert term, provided that the massless graviton remains the only propagating degree of freedom in the spacetime.

Posters

Ares, Filiberto

Title: *Entanglement entropy, compact Riemann surfaces and conformal transformations in fermionic chains*

Abstract: We have deepened into the connection that exists between compact Riemann surfaces and the entanglement entropy in a fermionic chain with time reversal and charge conjugation symmetry and finite. This connection was discovered by Its, Jin and Korepin for the XY spin chain and was extended by Its, Mezzadri and Mo for systems with finite long range interactions. From this connection, we find that there are certain conformal transformations under which the entropy remains invariant while the dispersion relation transforms like a primary conformal field with dimension given by the range of the couplings. In addition, exploiting this geometric point of view we explain some invariances and dualities found for the XY spin chain model entanglement entropy.

Brivio, Ilaria

Title: *Dark Matter with non-linear Higgs portals*

Abstract: The Higgs portal to scalar Dark Matter is considered in the context of non−linearly realised electroweak symmetry breaking. We determine the dominant interactions of gauge bosons and the physical Higgs particle to a scalar singlet dark matter candidate and study in detail the phenomenological consequences. We find that constraints on the parameter space derived from the measurement of dark matter relic abundance and from direct detection experiments change dramatically in presence of non−linearity in the Higgs sector. Based on 1511.01099.

del Rey, Rocío

Title: *Axionic signals at colliders with a dynamical Higgs*

Abstract: The couplings of a generic singlet pseudo−scalar Goldstone boson to the scalar sector of the Standard Model are considered. Leading and next to leading effective operators are considered in case the electroweak symmetry breaking is non−linearly realized, and the set is compared with those in linear realizations. Phenomenological consequences at LHC and differentiating signals in couplings to gauge bosons are discussed.

Santos, Isabel M.

Title: *The distribution of mass components in simulated disc galaxies*

Abstract: Using 22 hydrodynamical simulated galaxies in a CDM (cold dark matter) cosmological context we recover not only the observed baryonic Tully−Fisher relation, but also the observed "mass discrepancy−acceleration" relation, which reflects the distribution of the main components of the galaxies throughout their discs. This implies that the simulations, which span the range $52 < \mathrm{V}_{flat} < 222$ km/s, where V_{flat} is the circular velocity at the flat part of the rotation curve, and match galaxy scaling relations, are able to recover the observed relations between the distributions of stars, gas and dark matter over the radial range for which we have observational rotation curve data. Furthermore, we explicitly match the observed baryonic to halo mass relation for the first time with simulated galaxies. We discuss our results in the context of the baryon cycle that is inherent in these simulations, and with regards to the effect of baryonic processes on the distribution of dark matter.