Sessioni plenarie

FRANCESCO BIGAZZI, *Università di Firenze, INFN Pisa*
Corrispondenza AdS/CFT, Olografia e Materia Condensata
giovedì - Sala Papacello - ore 11:30

VITTORIO DEL DUCA, INFN–LNF
Ampiezze, loop di Wilson e simboli in $\mathsf{N} = 4$ Super–Yang–Mills
venerdì - Sala Papacello - ore 12:00

VITTORIO LUBICZ, Università di Roma Tre
Lattice e Flavour nell'era del SuperB
mercoledì - Sala Papacello - ore 9:30

ALESSANDRO SILVA, ICTP Trieste
Nonequilibrium quantum dynamics in many body systems
mercoledì - Sala Papacello - ore 15:00

MICHELE REDI, CERN, INFN Firenze
LHC results and implications for Physics Beyond the Standard Model
giovedì - Sala Papacello - ore 14:30

Sessioni parallele

ANDREA AMORETTI, Università di Genova
Il modello BF quadri-dimensionale in presenza di un bordo
mercoledì - Sala Papacello - ore 16:30

Come è noto il bordo nelle teorie topologiche è ricco di significati fisici. Per esempio, sul bordo della teoria BF tri-dimensionale si generano correnti chirali conservate che sono utili per lo studio di una nuova classe di materiali chiamati "isolanti topologici". Lo scopo del mio intervento è quello di illustrare, in maniera analoga a quanto già fatto nella teoria tri-dimensionale, in che modo nel modello BF in quattro dimensioni può essere introdotto un bordo tri-dimensionale e di discutere la fisica che si genera sul bordo stesso.

DAVIDE ASTOLFI, Università di Perugia
Quantum strings in $\mathsf{AdS}_4 \times \mathsf{CP}^3$: finite size spectrum vs. Bethe ansatz.
mercoledì - *Aula 1* - ore 11:00

Integrability has given hope of solving the spectral problem for the AdS/CFT correspondence in the planar limit. The construction of an all-loop asymptotic Bethe ansatz and subsequently of a Y-system has been established on the grounds of a huge amount of data, namely explicit computations of string theory or its dual gauge theory spectra in certain limits, judiciously chosen in order to elude computational challenges or weak-strong coupling interpolation issues. These limits often involve scaling appropriate parameters to infinity, and the most interesting effects arise when considering deviations from the strict limits. The two-dimensional world-sheet theory for strings in AdS is not interaction-free, even in the planar limit. Yet, it becomes free in the Penrose limit of the metric. Finite-size corrections to the Penrose limit can be treated perturbatively and correspond to an expansion in inverse powers of the background curvature radius

R. This approach has been pionereed for strings in $AdS_5 \times S^5$, conjectured to be dual to N=4, U(N) SYM theory in 3+1 dimensions. The results provided a milestone in building the ground blocks of the all-loop asymptotic Bethe ansatz and of its dressing phase factor interpolating from weak to strong coupling. In 2008 an exact duality has been conjectured between type IIA strings in $AdS_4 \times CP^3$ and ABJM Chern-Simons N=6 SYM theory, with gauge group U(N) X U(N). The integrability of this duality offers new interesting challenges, due to the reduced amount of supersymmetries, with respect to the AdS_5/CFT_4 correspondence. Yet an all-loop asymptotic Bethe ansatz and a Y-system have been conjectured. In arXiv:0807.1527, arXiv:0912.2257, arXiv:1101.0004, arXiv:1111.6628 the string theory in the near Penrose limit is studied and the spectrum is compared against the corresponding configurations of the Bethe system. In the talk I will describe the procedure, enlighten the further challenges and subtleties with respect to the AdS_5/CFT_4 case, and show results and perspectives.

Agnese Bissi, Niels Bohr Insitute
Holographic three-point functions
venerdì - *Aula 1* - ore 9:00

Marco Caldarelli, CPhT Polytechnique & LPT Orsay
Gregory-Laflamme instability and conformal symmetry
giovedì - Sala Papacello - ore 16:00

Alessio Camobreco, INFN Parma
Pure Spinor superstring in $AdS_4 \times CP^3$
giovedì - *Aula 1* - ore 17:30

Il formalismo degli spinori puri si estende in modo naturale agli spazi curvi, in particolare di tipo Anti-de Sitter, sotto forma di modello sigma non lineare su supercoset, cui si aggiunge un termine di ghost. La quantizzazione avviene attraverso il meccanismo di BRST con campi di ghost vincolati. In questo lavoro viene presentata una nuova formulazione per l'azione di spinore puro nello spazio $AdS_4 \times \mathbb{C}P^3$, in cui il vincolo sui ghost risolto. E' così possibile eseguire calcoli perturbativi, facendo uso del metodo del campo di background; in particolare si verifica che la carica centrale è zero fino all'ordine $1/R^2$ e si calcola l'azione efficace a 1-loop, provando l'assenza di contributi divergenti.

Andrea Cappelli, INFN Firenze
The birth of string theory
mercoledì - Sala Papacello - ore 14:45

A review of the main steps of the developments of the theory from 1968 to 1984, i.e. from the Veneziano formula to the string quantization, then to supersymmetry and the reformulation as a unified theory of all fundamental interactions.

Leonardo Castellani, Univ. Piemonte Orientale
Gravità noncommutativa
giovedì - *Aula 1* - ore 10:30

Si illustra un metodo, guidato dalla noncommutatività, per estendere la gravità di Einstein a una teoria di tipo $R + \theta R^2 + ...$ Vengono discussi gli accoppiamenti a campi di gauge, scalari e fermioni.

Mattia Cipriani, INFN Pisa
Effective action of non-Abelian monopole-vortex complex

venerdì - Sala Papacello - ore 10:30

In the context of N=2 SQCD with N quark hypermultiplets, we study a monopole -vortex junction and obtain the effective action for the moduli of this configuration. In the color-flavor locked vacuum with quarks with degenerate masses, a global diagonal symmetry group remains unbroken and vortices possess orientation moduli. When a junction is considered, this moduli end on the monopole. An effective action for this modes is obtained for models with SU(N), SO(N) and USp(N) gauge groups.

Denis Comelli, INFN Ferrara

Light from Dark matter through EW corrections

mercoledì - *Aula 1* - ore 17:30

We discuss how the inclusion of electroweak corrections can alter significantly the energy spectra of Standard Model particles originated from dark matter annihilations.

Marco Crisostomi, Università dell'Aquila & LNGS

Fenomenologia in Massive Gravity

giovedì - Sala Papacello - ore 17:30

Recentemente, una generalizzazione non lineare della teoria di Pauli-Fierz è stata dimostrata essere libera da instabilità. Verranno illustrate le soluzioni a simmetria sferica e quelle cosmologiche di questa teoria, mettendo in evidenza le analogie e le differenze rispetto alla Relatività Generale, in modo da discuterne l'effettiva plausibilità. Lo stesso verrà fatto riguardo le perturbazioni cosmologiche, mostrando la reale validità dell'analisi perturbativa in questo modello.

Aldo Di Biasio, Università di Parma & INFN

Tecniche di interpolazione ed analogie meccaniche in sistemi disordinati

giovedì - Sala Papacello - ore 9:00

Le tecniche basate sull'utilizzo di funzioni di partizione interpolanti hanno permesso negli ultimi anni di aggiungere nuovi tasselli alla comprensione dei sistemi disordinati quali i vetri di spin in campo medio. Ad esempio queste tecniche sono alla base della dimostrazione dell'esistenza del limite termodinamico dell'energia libera e della derivazione rigorosa della formula di Parisi per il modello di Sherrington-Kirkpatrick. L'interpolazione permette di mappare modelli di sistemi di spin disordinati in sistemi meccanici classici, governati da un'equazione di Hamilton-Jacobi, la cui risoluzione tramite i metodi ordinari della meccanica analitica permette di evidenziare anche simmetrie e leggi di conservazione delle grandezze meccaniche. In questo lavoro mostriamo come, tramite l'utilizzo di un'opportuna funzione di partizione interpolante, l'energia libera del modello di campo medio per i vetri di spin, con interazioni a p-ple con $p \geq 2$ e pari, può essere ottenuta esplicitamente a partire da un'equazione di Hamilton-Jacobi in cui il potenziale è legato alle fluttuazioni del parametro d'ordine.

Lorenzo Di Pietro, SISSA

Dynamical Completions of Generalized O'Raifertaigh Models

venerdì - Sala Papacello - ore 11:00

After reviewing the interplay between Dynamical Supersymmetry Breaking and R-symmetry, and the related problem of gaugino screening, we discuss features of low energy O'Raifertaigh models that can give unsupressed gaugino mass. Based on arXiv:1111.2307 we present gauge theory completions of such models, admitting supersymmetry breaking vacua with spontaneously broken R-symmetry. Our models are simple deformations of ITIY models, i.e. supersymmetric theories

with gauge group Sp(N), N+1 flavors and additional singlets, with a tree level superpotential which explicitly breaks (part of) the global symmetry. Depending on the nature of the deformation, we obtain effective O'Raifertaigh-like models that once embedded in direct gauge mediation scenarios can give low energy spectra with either suppressed or unsuppressed gaugino mass.

Maria Cristina Diamantini, Università di Perugia
3D Topological states of matter and Spin-Charge separation
mercoledì - Sala Papacello - ore 17:00

Electron fractionalization into spinons and chargeons plays a crucial role in 2D models of strongly correlated electrons. In this paper we show that spin-charge separation is not a phenomenon confined to lower dimensions but, rather, we present a field-theoretic model in which it is realized in 3D. The model involves two gauge fields, a standard one and a two-form gauge field. The physical picture is that of a two-fluid model of chargeons and spinons interacting by the topological BF term. When a Higgs mechanism of the second kind for the two-form gauge field takes place, chargeons and spinons are bound together into a charge 1 particle with spin 1/2. The mechanism is the same one that gives spin to quarks bound into mesons in non-critical string theories and involves the self-intersection number of surfaces in 4D space-time. A state with free chargeons and spinons is a topological insulator. When chargeons condense, the system becomes a topological superconductor; a condensate of spinons, instead realizes U(1) charge confinement.

Ruggero Ferrari, Università di Milano
On the Phase Diagram of Massive Yang-Mills
venerdì - Sala Papacello - ore 9:30

The phases of a lattice gauge model for the massive Yang-Mills are investigated. The phase diagram supports the recent conjecture on the large energy behavior of nonlinearly realized massive gauge theories (i.e. mass *à la* Stückelberg, no Higgs mechanism), envisaging a phase transition to an asymptotically free massless Yang-Mills theory.

Remo Garattini, Università di Bergamo
Effects of Modified Dispersion Relations on the Cosmological Constant and Black Hole Entropy Computation
giovedì - Sala Papacello - ore 17:00

Quantum Field Theory is plagued by divergences in the attempt to calculate physical quantities. Standard techniques of regularization and renormalization are used to keep under control such a problem. In this talk we would like to use a different scheme based on Modified Dispersion Relations (MDR) to remove infinities appearing in one loop approximation in contrast to what happens in conventional approaches. In particular, we apply the MDR regularization to the computation of the entropy of a Schwarzschild black hole from one side and the Zero Point Energy (ZPE) of the graviton from the other side. The graviton ZPE is connected to the cosmological constant by means of of the Wheeler-DeWitt equation. Implications on the inflation will briefly be discussed.

Lorenzo Giulio Celso Gentile, Università di Padova & INFN
First order correction to Navier-Stokes equations from bulk fermions
mercoledì - Sala Papacello - ore 17:30

Simone Giacomelli, Scuola Normale Superiore
Superconformal points in N=2 SQCD
giovedì - *Aula 1* - ore 10:00

Luca Giacone, Università di Torino
Non-perturbative aspects of gauge/gravity correspondence
venerdì - *Aula 1* - ore 10:00

Valentina Giangreco Puletti, Chalmers University of Technology, Göteborg
Holographic metals
mercoledì - Sala Papacello - ore 18:00

In 2+1 dimensions, strongly coupled charged fermions at finite density give rise to "strange" metallic behaviors. Gauge/gravity duality may provide useful new insights and considerable effort has been put into developing holographic duals of these systems in recent years. In this direction, an important step is to demonstrate how a Fermi surface may be encoded in a dual geometry. I will discuss some recent results in the study of Fermi surfaces in holographic metallic states, where we use the so-called Friedel oscillations to characterize the boundary systems, without reference to probe fermion calculations.

Stefano Giusto, Università di Padova
D-brane bound state geometries from string amplitudes
giovedì - *Aula 1* - ore 16:00

We propose a method to derive the geometries sourced by a bound state of D-branes from the computation of disk amplitudes in string theory. These geometries should provide the gravitational description of the microstates of black holes.

Gianluca Inverso, Università di Roma Tor Vergata
Gaugings and Vacua of Maximal D=4 Supergravity
giovedì - Sala Papacello - ore 16:30

I will discuss an effective method to find vacua of gauged supergravity and apply it to the maximal theory in four dimensions. This leads to new Anti de Sitter and Minkowski vacuum solutions, as well as to new classes of gauge theories. Interesting links between different gaugings, the associated vacuum solutions, and their stability properties as well as the allowed values of the cosmological constant are outlined.

Luca Lopez, Scuola Normale Superiore
On the cubic interactions of massive and partially-massless higher spins in (A)dS
giovedì - *Aula 1* - ore 9:30

Cubic interactions of massive and partially-massless totally-symmetric higher-spin fields in any constant-curvature background of dimension greater than three are investigated. Making use of the ambient-space formalism, the consistency condition for the traceless and transverse parts of the parity-invariant interactions is recast into a system of partial differential equations. The latter can be explicitly solved for given s_1-s_2-s_3 couplings and the 2-2-2 and 3-3-2 examples are provided in detail for general choices of the masses. On the other hand, the general solutions for the interactions involving massive and massless fields are expressed in a compact form as generating functions of all the consistent couplings. The Stückelberg formulation of the cubic interactions as well as their massless limits are also analyzed.

Alessio Maiezza, LNGS
Flavor physics, epsilon-prime and Parity restoration at LHC
mercoledì - *Aula 1* - ore 18:00

In the context of minimal Left-Right symmetry, I review the tests from flavour physics, showing that the lower limit on the right-handed scale is in the LHC range. In particular, I address New Physics in the gluomagnetic flavor-changing transition and show that a potentially large non-perturbative contribution to the CP-violation parameter epsilon-prime can be a consequence of the chiral enhancement of Left-Right theory with respect to the SM. I therefore analyze the constraints on the parameters of the model from epsilon-prime, together with other conditions from K and B mesons, and show that the scale of LR symmetry can be as low as TeV. Furthermore a possible solution for the present tensions in CP-violation of Bd and Bs mesons can be avoided. The constraints become particulary interesting for the scenario of low scale restoration of parity at LHC, which could manifest through the spectacular signatures of the right-handed gauge boson WR, proving also the Majorana nature of neutrino.

Andrea Marini, Università di Perugia

Thermal string probes in AdS and finite temperature Wilson loops

venerdì - *Aula 1* - ore 10:30

We apply a new description of thermal fundamental string probes to the study of finite temperature Wilson loops in the context of the AdS/CFT correspondence. Previously this problem has been considered using extremal probes even though the background is at finite temperature. The new description includes the thermal excitations of the string probe and demands the probe to be in thermodynamic equilibrium with the Anti-de Sitter black hole background. As a result of our analysis we find a new term in the potential between static quarks in the symmetric representation which for sufficiently small temperatures is the leading correction to the Coulomb force potential. We also find an order 1/N correction to the onset of the Debye screening of the quarks.

Gabriele Martelloni, Università di Firenze

Avatars of the generalized cusp in ABJ(M) N=6 Super Chern-Simons theories

mercoledì - *Aula 1* - ore 11:30

We construct a generalized cusped Wilson loop operator in N=6 Super Chern-Simons theories which is locally invariant under half of the supercharges. It depends on two parameters and interpolates smoothly between the 1/2 BPS line or circle and a pair of antiparallel lines, representing a natural generalization of the quark-antiquark potential in ABJ(M) theories. For particular choices of the parameters we obtain 1/6 BPS configurations that, mapped on the bidimensional sphere by a conformal transformation, realizes a three dimensional analogue of the wedge DGRT Wilson loop of N=4 SYM. The cusp couples, in addition to the gauge and scalar fields of the theory, also to the fermions in the bifundamental representation of the U(N) x U(M) gauge group and its expectation value is expressed as the holonomy of a suitable superconnection. We discuss the definition of these observables in terms of super traces and the role of the boundary conditions of fermions along the loop. Our results open the possibility to explore in the three dimensional case the connection between localization properties and integrability, recently advocated in D=4.

David Marzocca, SISSA

General Composite Higgs Models

mercoledì - Sala Papacello - ore 11:30

We construct a general class of pseudo-Goldstone composite Higgs models, within the minimal SO(5)/SO(4) coset structure, that are not necessarily of moose-type. We characterize the main properties these models should have in order to give rise to a Higgs mass at around 125 GeV. We assume the existence of relatively light and weakly coupled spin 1 and 1/2 resonances. In absence of a symmetry principle, we introduce the Minimal Higgs Potential (MHP) hypothesis: the Higgs

potential is assumed to be one-loop dominated by the SM fields and the above resonances, with a contribution that is made calculable by imposing suitable generalizations of the first and second Weinberg sum rules. We show that a 125 GeV Higgs requires light, often sub-TeV, fermion resonances. The composite Higgs models of the moose-type considered in the literature can also be seen as particular limits of our class of models.

Stefano Massai, IPhT, CEA/Saclay

Supersymmetry breaking from anti-branes in flux compactifications

giovedì - *Aula 1* - ore 16:30

I will discuss recent advances in the supergravity computation of the backreaction of anti-D3 branes on the Klebanov-Strassler geometry. This solution provides a gravity dual of a metastable non-supersymmetric state in a confining N=1 gauge theory and it has many applications in models of string cosmology. I will also describe similar solutions in M-theory and discuss the interpretation of certain infrared singularities which are a generic feature of such anti-brane solutions.

Andrea Mezzalira, INFN Torino (Alessandria)

Supersymmetric Fluid Dynamics

venerdì - *Aula 1* - ore 11:00

Stefano Mori, Università di Parma & INFN

Correlators of Hopf Wilson loops in the AdS/CFT correspondence

mercoledì - *Aula 1* - ore 12:00

We study at quantum level the correlator of two Wilson loops lying on Hopf fibers on S^3 in N=4 SYM. At strong coupling the computation is performed through AdS/CFT correspondence. A solution connecting the two loops is presented in the case of opposite oriented contours with the same coupling to scalar fields. The solution depends on angular parameters and smoothly interpolates between non-BPS and BPS configurations. The system can be interpreted as a non-trivial deformation of the anti-parallel lines giving the static quark-antiquark potential that is reproduced in the small separation limit. In the case of equally oriented fibers arguments against the existence of a connected solution are shown. This fact supports the exactness of the matrix model for the correlator of the two loops, in the case of BPS configurations. Luca Griguolo, Stefano Mori, Fabrizio Nieri and Domenico Seminara, Correlators of Hopf Wilosn loops in the AdS/CFT correspondence (`arXiv:1203.3413`).

Francesco Negro, Università di Genova & INFN

Dipendenza da theta della temperatura di deconfinamento nelle teorie di Yang-Mills

mercoledì - Sala Papacello - ore 11:00

Si discute la determinazione della dipendenza dal parametro theta della temperatura di deconfinamento della teoria di pura gauge SU(3) mediante metodi di reticolo. Si osserva come essa diminuisca in presenza del termine topologico theta. Le simulazioni numeriche sono effettuate con metodi di reticolo utilizzando un valore immaginario per il parametro theta per evitare il problema del segno e poi effettuando una continuazione analitica. Si da anche una stima di questa dipendenza nel limite di grande numero di colori N e la si confronta con il risultato ottenuto su reticolo.

Giulia Pancheri, INFN-Frascati

Asymptotic saturation of the Froissart bound from QCD resummation of infrared gluons

mercoledì - *Aula 1* - ore 17:00

I shall discuss a model which probes the infrared region of QCD through the total and elastic hadronic cross-sections. The model is based on the eikonal representation, with QCD mini-jets to drive the rise and soft gluon resummation to tame the rise into a behaviour consistent with the Froissart bound. I will present our analysis for recently measured quantities like the total and inelastic cross-sections, as well as the differential elastic cross-section. I will also discuss the survival probability for large rapidity gaps, which depends on the model used for the inelastic total cross-section and which is important in studies of light Higgs boson production in the forward region. Using our model, one can test whether present measurements at LHC are compatible with predictions from extra-dimensions. Results from other currently used models will also be compared with data and such predictions.

Tiziano Peraro, MPI - Munich
Scattering amplitude at the integrand level
giovedì - *Aula 1* - ore 9:00

This talk concerns the reduction at the integrand level of loop amplitudes. A semi-analytic method for the integrand reduction of one-loop amplitudes, based on the systematic application of the Laurent expansions to the integrand-decomposition, is presented. The traditional decomposition is also extended to non-renormalizable theories where the rank of the numerator of the integrand can be greater than the number of denominators. The firsts results on the generalization of the integrand reduction at higher loops will be discussed as well.

Alessandro Pilloni, INFN Roma
$H \to \gamma\,\gamma$: a Comment on the Indeterminacy of Non-Gauge-Invariant Integrals
venerdì - Sala Papacello - ore 10:00

We reanalyze the recent computation of the amplitude of the Higgs boson decay into two photons presented by Gastmans et al.. The reasons for which this result cannot be the correct one have been discussed in some recent papers. We address here the general issue of the indeterminacy of integrals with four-dimensional gauge-breaking regulators and to which extent it might eventually be solved by imposing physical constraints. Imposing gauge invariance as the last step upon R_ξ gauge calculations with four-dimensional gauge-breaking regulators, allows indeed to recover the well known $H \to \gamma\,\gamma$ result. However we show that in the particular case of the unitary gauge, the indeterminacy cannot be tackled in this same way. The combination of unitary gauge with a cutoff regularization scheme turns out to be non-predictive.

Luigi Pilo, Università dell'Aquila
Recenti sviluppi in gravità con massa
mercoledì - Sala Papacello - ore 12:30

Verranno discussi criticamente alcuni recenti sviluppi nel campo della gravità massiva. L'idea di partenza è di cercare a modificare a grande distanza la teoria di Einstein introducendo in modo opportuno un termine di massa per il gravitone. In particolare si illustrerà un modello recente privo di ghost e le sue sue conseguenze fenomenologiche con enfasi particolare alle soluzioni cosmologiche ed a simmetria sferica.

Flavio Porri, SISSA

Holographic correlators and susy breaking
mercoledì - Sala Papacello - ore 12:00

We compute two-point functions of operators related by SUSY using holography from an asymptotically AdS, SUSY breaking, gravitational background. In the context of General Gauge Mediation, this allows us to study visible effect of an holographic hidden sector.

Enrico Prati, C.N.R., Lab. NDM, Agrate Brianza
Quantum phase transitions in few electron systems
giovedì - Sala Papacello - ore 9:30

The single ion implantation of individual atoms in semiconductor lattices paved the way towards the control at the atomic level of quantum properties of systems made of few atoms. Few interacting quantum objects embedded in a crystal mimic the behavior of emerging free individual particles in a substrate, whose emerging properties are determined by the nature of the substrate. I review our recent experimental results obtained in silicon quantum devices in which few atoms have been implanted and measured through quantum transport at cryogenic temperature. A quantum phase transition between a Fermi glass and a Wigner-like phase is presented, and the control of different interaction mechanisms is observed through quantum tunneling. Our experiments provide a valuable tool for probing emergent properties at the single particle level and suggest possible mechanisms for emerging properties in high energy particle physics.

CarloAlberto Ratti, Università del Salento
Energy of closed semi-classical short spinning strings from algebraic curve
mercoledì - *Aula 1* - ore 12:30

Closed string solutions are considered in $AdS_5 \times S^5$ and in $AdS_4 \times CP^3$ backgrounds. We quantize them semi-classically by algebraic curve methods based on the integrable structure of the string world-sheet sigma-model. The energy of these states depend on the classical charges which describe the rotation of the string in the space. We compute it when at least the AdS spin S is taken small ("short string" limit). This is linked via AdS/CFT to the anomalous dimensions of short operators in the dual gauge theories (both N=4 and ABJM).

Patrizio Ripesi, Università di Roma Tor Vergata
Numerical simulations of turbulent Rayleigh-Benard systems with complex boundary conditions
giovedì - Sala Papacello - ore 10:00

Thermal Rayleigh-Benard (RB) convection is common in a variety of dynamical systems and with applications spanning from astrophysics to Earth and Atmospheric physics. The RB system consists of a fluid subject to an external gravity field g placed between two plates, heated from below and cooled from above. The associated thermal dynamic is usually parametrized in terms of the Rayleigh number ($Ra = \frac{g\alpha\Delta T H^3}{\nu k}$), where H is the distance between the plates, α and k are the thermal expansion and diffusivity coefficients of the fluid and ν is the kinematic viscosity.The system is linearly unstable and convection starts above a critical Rayleigh number $Ra > Ra_c$, the latter being determined by the fluid properties and boundary conditions of the system. Highly chaotic dynamics develops at incresing Ra, reaching fully turbulent convection for $Ra \sim 10^8$ and higher. In a paper in preparation the dependece of Ra_c on the surface heterogeneities is investigated. In particular, we study the onset of large scale thermal convection in a RB cell the wall of which consists of a periodic sequence of insulating ($\partial_z T = 0$) and "thermalized" ($T = T_{up}$)

patches, and quantify the effect of the boundary heterogeneity on the critical Rayleigh number $\mathtt{Ra_c}$. This problem is important for a series of geophysical application, such as the role of the sea-ice on the heat transfer between the atmosphere and the ocean and its effects on thermohaline circulation and Deep Water formation, the insulating effect of continents on mantle convection in the Earth and many others. Our theoretical picture is validated against numerical simulations performed with a Thermal Lattice Boltzmann (LB) numerical scheme. Numerical and analitical values of $\mathtt{Ra_c}$, depending on the size of the insulating areas and their periodicity wavelength, are evaluated. Finally, some preliminary results in the fully turbulent regime are presented.

Fabio Saracco, Università di Milano Bicocca
Through the massive O6-plane
giovedì - *Aula 1* - ore 17:00

In the supergravity IIA theories, Romans mass, i.e. a scalar RR-flux, has been used in several vacuum models as one of the main characters. Moreover, it was shown to prevent uplift to 11 dimensions. This can be a problem in analyzing the unphysical region around orientifold planes (planes of fixed point under some parity transformations), since in some cases, like the Orientifold-6 in the absence of Romans mass, the unphysical region is resolved after the uplifting. I am going to show that the O6-plane in presence of Romans mass is able to protect itself from singularities without uplifting.

Christian Schubert, IFM, UMSNH, Morelia, Mexico
Schwinger pair creation of particles and strings
venerdì - Sala Papacello - ore 9:00

Schwinger's famous 1951 formula for the electron-positron pair creation rate in a constant electric field can nowadays be derived in many ways. Perhaps the most elegant one is the method of worldline instantons. I will explain this method, and then extend it to the case of open string pair creation in an electric field, where it allows one to determine the pair creation rate without computing the spectrum of the string.

Paola Verrucchi Istituto dei Sistemi Complessi -CNR- Firenze
Open quantum systems and the parametric representation: from entanglement to Berry's phase
giovedì - Sala Papacello - ore 10:30

Open quantum systems are usually treated, in particular in the realm of quantum information theory and quantum computation, in terms of reduced density matrices, which provide a definition of the state of the principal system, via the partial trace operation over the environment. This approach proves to be a powerful tool to investigate relevant features of the open system evolution. On the other hand, the density matrix formulation does not allow to keep track of any phase information between the system and the environment and induce an uncontrollable loss of information which prevents some phenomena to be properly described, specifically those related to the entanglement between the principal system and its environment. In this work, we propose an alternative description of an open quantum system, based on a parametric representation of the environment degrees of freedom, such that the entanglement properties of the global state are unaffected. The representation is then used to describe a prototypical composite system, namely that made of a spin-1/2 (the principal system) and a spin-S (the environment), interacting via a Heisenberg Hamiltonian. By the parametric representation, we show that the emergence of a Berry's geometric phase for a qubit embedded in an external magnetic field follows from the fact that the true physical set up, of which the q̈ubit in a fieldïs just a semiclassical-like description, is in fact a fully quantum composite system, made of a qubit interacting with a spin-S, and in

an entangled state. In fact, we find that the Von Neumann entropy of the spin-1/2, due to the existence of the environment (the spin-S), is the binary entropy of its normalized Berry phase.

Giulia Zanderighi, University of Oxford
SINLO: Sudakov Improved Next-to-Leading-Order
mercoledì - *Aula 1* - ore 16:30

We describe a new, simple method to implement local scales choices in next-to-leading order calculations, and to supplement these results with appropriate Sudakov form factors.

Andrey Zayakin, INFN-Perugia
Three point functions of BMN operators at weak and strong coupling
venerdì - *Aula 1* - ore 9:30

I present the string-based calculation for the correlators of a fully dynamical three-point correlator of BMN operators via the Dobashi-Yoneya vertex, and a calculation of the same quantity within planar field theory. I discuss the tree-level exact correspondence and a possibility to upgrade it up to the one-loop level

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