Parallel Sessions

Wednesday 28

11:00 - 13:05 Room A

Marco Caldarelli (Southampton U.): *AdS/Ricci-flat correspondence and holography in asymptotically flat spacetimes*

I will present a remarkable connection between asymptotically anti-de Sitter (AdS) spacetimes and a class of vacuum gravity solutions. I will explain how this link, the AdS/Ricci-flat correspondence, endows these Ricci-flat spacetimes with a generalized conformal symmetry and a holographic structure, both inherited from AdS. This will be illustrated with the help of simple examples, initiating thus the discussion of holography for asymptotically flat spacetimes

Igor Pesando (Torino U.): *Correlators with excited twisted states*

We show that amplitudes with generic untwisted and generic excited twisted states can be computed using a slightly generalization of Wick theorem. This is done both using path integral approach and canonical quantization

Carlo Maccaferri (Torino U. and INFN): *Exact non-perturbative results for marginal deformations in open string field theory*

It has been a long-standing puzzle to understand how and if open string field theory is able or not to describe configurations in the D-brane moduli space which are "far" from the starting D-brane system. Classical numerical results by Sen and Zwiebach (2000) showed that the marginal solutions describing D-branes at generic points in their moduli space, encounter a branch point at a finite value of the SFT marginal parameter and cease to exist afterwords. Therefore the numerically found solutions are not able to describe the full D-brane moduli space, but only a portion of it. Thanks to a newly constructed family of analytic solutions for marginal deformations, I am able to precisely show that the SFT marginal parameter used by Sen and Zwiebach is a non-injective function of the gauge invariant D-brane modulus and, after reaching a maximum, it starts decreasing towards zero. This explains why the family of marginal solutions break down if we try to parametrize them through the SFT marginal parameter and it reassures that the full D-brane moduli space is correctlly covered.

Stefano Bolognesi (Pisa U.): *Hyperbolic monopoles, JNR data and spectral curves*

A large class of explicit hyperbolic monopole solutions can be obtained from JNR instanton data, if the curvature of hyperbolic space is suitably tuned. Here we provide explicit formulae for both the monopole spectral curve and its rational map in terms of JNR data. Examples with platonic symmetry are presented, together with some one-parameter families with cyclic and dihedral symmetries. These families include hyperbolic analogues of geodesics that describe symmetric monopole scatterings in Euclidean space and we illustrate the results with energy density isosurfaces. There is a metric on the moduli space of hyperbolic monopoles, defined using the abelian connection on the boundary of hyperbolic space, and we provide a simple integral formula for this metric on the space of JNR data.

Roberto Auzzi (U. Cattolica del Sacro Cuore, Brescia): *On periodically driven AdS/CFT*

I'll consider a thermally isolated conformal field theory in four dimensions which undergoes a repeated deformation by an external periodic time-dependent source coupled to an operator of dimension Delta.
In order to study the details of thermalization in the dual field theory, the leading-order backreaction on the AdS black brane metric is computed. The evolution of the event and the apparent horizons is monitored; the increase of area in each cycle coincides with the increase in the equilibrium entropy corresponding to the amount of energy dissipated. The time evolution of the entanglement entropy of a spherical region and that of the two-points function of a probe operator with a large dimension are also inspected; the delay in the thermalization of these quantities is proportional to the size of the region which is being probed. I'll comment on a possible transition in the time evolution of the energy fluctuations as a function of the operator dimension Delta.

11:00 - 13:05 Room B

Mario Collura (Pisa U.): *Interaction quench in one-dimensional Bose gas*

We consider the quench of the one-dimensional Bose gas from zero to infinite interaction, in which the relation between modes is nonlinear, and consequently Wick's theorem does not hold. We provide exact analytical results for the time evolution of the dynamical density-density correlation function. We prove that its stationary value is described by a Generalized Gibbs Ensemble (GGE). Finally, we analyze the entanglement properties of the asymptotic steady state after a quench; we provide exact analytical results both for the leading extensive parts and the subleading terms for the entropies as well as for the cumulants of the particle number fluctuations.

Alessio Squarcini (SISSA and INFN, Trieste): *Off-Critical interfaces in Two Dimensions. Exact results*

The exact theory of phase separation in a two-dimensional wedge is derived from the properties of the order parameter and boundary condition changing operators in field theory. For a shallow wedge we determine the passage probability for an interface with endpoints on the boundary. For generic opening angles we exhibit the fundamental origin of the filling transition condition and of the property known as wedge covariance.

Enrico Randellini (Firenze U. and INFN): *Partition Functions and Stability Criteria of Topological Insulators*

The study of topological phases of matter has considerably grown in recent years and new systems have been investigated both theoretically and experimentally in two and three spatial dimensions (2D and 3D). These phases have some features similar to the Quantum Hall Effect but do not require magnetic fields. These are the Quantum Spin Hall E ect, Topological Insulators and Topological Superconductors. In my talk I will describe the non chiral edge excitations of the 2D time-reversal invariant Topological Insulators by means of their partition function. I will focus on the problem of the stability of topological phases protected by time-reversal symmetry and I will show how this is related with the existence of discrete anomalies and the lack of modular invariance of the partition function.

Gabriele Martelloni (Pisa U.)**:** *Quantum quench from a tensor thermal state: free and interacting integrable systems*

We consider a non-interacting Fermi gas in d dimensions, both in the non-relativistic and relativistic case. The system of size Ld is initially prepared into two halves L and R, each of them thermalized at two different temperatures, TL and TR respectively. At time t = 0 the two halves are put in contact and the entire system is left to evolve unitarily. We show that, in the thermodynamic limit, the time evolution of the particle and energy densities is perfectly described by a semiclassical approach which permits to analytically evaluate the correspondent station- ary currents. In particular, in the case of non-relativistic fermions, we find a low-temperature behavior for the particle and energy currents which is independent from the dimensionality d of the system, being proportional to the difference TL2 − TR2 . Moreover we consider the same problem of two halves, thermalized at different temperatures, for a generic interacting integrable system in 1D and in particular we show some preliminary results for the Lieb-Liniger model.

Alessandro Braggio (CNR-SPIN / INFN, Genova): *Resonant detection and spectroscopy of multiple Hall quasiparticles*

We investigate the finite frequency (f.f.) noise properties of edge states in the quantum Hall regime. We consider the measurement scheme of a resonant detector coupled to a quantum point contact in the weak-backscattering limit. A detailed analysis of the difference between the "measured" noise, due to the presence of the resonant detector, and the symmetrized f.f. noise is presented. We discuss both the Laughlin and Jain sequences, studying the tunnelling excitations in these hierarchical models. We argue that the measured noise can better distinguish between the different excitations[4] in the tunnelling process with respect to the symmetrized f.f. counterpart in an experimentally relevant range of parameters. Finally, we illustrate the effects of the detector temperature on the sensibility of this measure.
http://arxiv.org/abs/1402.6488

16:30 - 18:10 Room A

Simone Giacomelli (ULB, Bruxelles): *BPS Quivers and N=2 superconformal theories*

The BPS spectrum of a large class of N=2 theories can be encoded in an oriented graph called BPS quiver. In this talk I will review the BPS quiver technique and the 4d/2d correspondence introduced by Cecotti, Neitzke and Vafa. I will then explain how the BPS quiver technology can be used to study a class of N=2 superconformal models. The computation of various quantities can be related via the 4d/2d correspondence to two-dimensional problems.

Lorenzo Bianchi (Humboldt U. Berlin): *Unitarity methods for scattering in two dimensions*

The standard unitarity-cut method is applied to several massive two-dimensional models, including the world-sheet AdS5 x S5 superstring, to compute 2 ? 2 scattering S-matrices at one loop from tree level amplitudes. Evidence is found for the cut-constructibility of supersymmetric integrable models, while for models without supersymmetry (but integrable) the missing rational terms can be interpreted as a shift in the coupling.

Marta Leoni (Milano U. and INFN): *Four-points Scattering Amplitudes in N = 2 Superconformal QCD*

We computed four-point scattering amplitudes in N = 2 Superconformal QCD using N = 1 superspace Feynman diagrams. The computation was performed at one loop with general external matter configuration and at two loops with external fields in the fundamental representation. We discuss the relationship between our results and N=4 SYM scattering amplitudes.

Lorenzo Giulio Celso Gentile (Padova U.): *Fermions, Wigs, and Attractors*

The modifications to the attractor mechanism due to fermionic corrections in N = 2, D = 4 supergravity is presented, showing, at the fourth order, a new contribution to the horizon values of scalar fields of the vector multiplets. The opposite result is found in N = 2, D = 5 1/2-BPS (electric) extremal black hole for ungauged Maxwell-Einstein supergravity.

Sujay Ashok (Institute of Mathematical Sciences, Chennai): *Higher poles and crossing phenomena from elliptic genera*

We demonstrate that Appell-Lerch sums with higher order poles as well as their modular covariant completions arise as partition functions in the cigar conformal field theory with worldsheet supersymmetry. The modular covariant derivatives of the elliptic genus of the cigar give rise to operator insertions corresponding to (powers of) right-moving momentum, left-moving fermion number, as well as a term corresponding to an ordinary zero mode partition sum. To show this, we demonstrate how the right-moving supersymmetric quantum mechanics (and in particular the Hamiltonian and spectral density) depend on the imaginary part of the chemical potential for angular momentum. As a consequence of our analysis we find that varying the imaginary part of the chemical potential for angular momentum on the cigar gives rise to a wall-crossing phenomenon in the bound state contribution to the elliptic genus, while the full elliptic genus is a continuous function of the chemical potential.

16:30 - 18:10 Room B

Lorenzo Tancredi (Zürich U.): *Schouten identities for multi-loop Feynman integrals*

A new class of identities for Feynman graph amplitudes, dubbed Schouten identities, valid at fixed integer value of the dimension d is proposed. The identities are then used in the case of the two loop sunrise graph with arbitrary masses for recovering the second order differential equation for the scalar amplitude in d=2 dimensions.

Tiziano Peraro (Max-Planck-Institut, Munich): *Semi-analytic and algebraic techniques for Integrand Reduction*

I will present some recently developed semi-analytic and algebraic techniques for the integrand reduction of loop integrals. I will describe the Laurent expansion method for one-loop amplitudes, implemented in the library Ninja. I will also focus on multivariate polynomial division techniques, which have been used to build a coherent framework valid at any number of loops.

Giulio Falcioni (Torino U. and INFN): *Multiple gluon exchange webs*

The soft anomalous dimension governs the infrared singularities of gauge theory scattering amplitudes and it can be calculated perturbatively as the exponential of sets of Feynman diagrams, called webs. In this talk I'd like to introduce recent progress in our understanding of infrared divergences through the mathematical structure of webs. I'll discuss the results of perturbative calculations of the webs of a particular class, the multiple gluon exchange webs or MGEW, leading to an ansatz for the basis of functions for MGEW at all orders in perturbation theory.

William Javier Torres Bobadilla (Padova U. and INFN): *Generalised Unitarity for Dimensionally Regulated Amplitudes*

I will present a novel set of Feynman rules and generalised unitarity cut-conditions for computing one-loop amplitudes via d-dimensional integrand reduction algorithm. Our algorithm is suited for analytic as well as numerical result, because all ingredients turn out to have a four-dimensional representation. I will show its applications to NLO QCD corrections, and discuss their use for scattering amplitudes beyond one-loop.

Enrico Onofri (Parma U. and INFN): *Teaching Wave Mechanics with Matlab*

I'll present several programs which I developed along the years which allow to compute energy spectra, tunneling amplitudes, animations of Schroedinger wave packets in various potentials in one and two dimensions, perturbation theory to high orders, Clebsch-Gordan, and more. All very elementary, but potentially useful in introductory QM courses.

Thursday 29

11:00 - 13:05 Room A

Federico Corberi (Salerno U.): *Condensation of large fluctuations in a thermodynamical system*

Condensation of fluctuations is an interesting phenomenon conceptually distinct from condensation on average. One stricking feature is that, contrary to what happens on average, condensation of fluctuations may occurr even in the absence of interactions or external constraints. This surprising phenomenon is investigated, in and out of equilibrium, in the context of simple models of classical statistical mechanics, like the Gaussian model or the Spherical model, chosen as paradigmatical non-interacting or interacting systems. The explanation emerges from the duality between large deviation events in the given system and typical events in a new and appropriately biased system. It is shown that the bias in the companion system induces a mean-field-like effective interaction. Phase diagrams, covering both the equilibrium and the off-equilibrium regimes, are derived for observables representative of generic behaviors. The difference in the experimantal protocols required to observe the two facets of condensation is highlighted.

Michele Buzzicotti (U. Roma Tor Vergata and INFN): *Shell models for fully developed turbolence*

We briefly review the main results obtained in the realm of shell models for the energy-turbulent cascade, showing the most important properties that make them optimal for understanding nonlinear dynamics. We apply an exact decomposition of the velocity field in a helical Fourier basis. Changing the nonlinear terms and evolving the dinamic keeping only those velocity components carrying a well-defined (positive or negative) helicity, we try to understand the nature of the energy transfer.

Fabio Franchini (SISSA/M.I.T.): *Universal Quantum Simulator, Local Convertibility and Edge States in Many-body Systems*

In some many-body systems, certain ground state entanglement (Renyi) entropies increase even as the correlation length decreases. This entanglement non-monotonicity implies a stronger ``quantum nature'' of the wave function and gives it a higher computational power, compared to classical manipulations.
In this work we demonstrate that such a phenomenon, known as non-local convertibility, is due to the edge state (de)construction occurring in the system. To this end, we employ the example of the Ising chain, displaying an order-disorder quantum phase transitions. Employing both analytical and numerical methods, we compute entanglement entropies for various system's bipartitions (A|B) and consider ground states with and without Majorana edge states. We find that the thermal ground states, enjoying the Hamiltonian symmetries, show non-local convertibility if either A or B are smaller than, or of the order of, the correlation length. In contrast, the ordered (symmetry breaking) ground state is always locally convertible. The edge states behavior explains all these results and could disclose a paradigm to understand local convertibility in other quantum phases of matter. The connection we establish between convertibility and non-local, quantum correlations provides a clear criterion of which features a universal quantum simulator should possess to outperform a classical machine.

Spyros Sotiriadis (Pisa U.): *Loss of memory of non-Gaussian initial correlations under Gaussian unitary evolution*

The ground state of an interacting Hamiltonian exhibits non-Gaussian field correlations, i.e. it does not satisfy Wick's theorem. When a one-dimensional system that initially lies in such a state, evolves under a non-interacting Hamiltonian, it may exhibit (under quite general conditions) relaxation of its field correlations, due to the interference of the momentum modes in which it can be decomposed. We show that, as a direct consequence of a fundamental property of physically acceptable ground states, the cluster decomposition principle, the large time asymptotic field correlations are Gaussian. This means that memory of the non-Gaussian content of the initial correlations is lost under the Gaussian unitary evolution and the system effectively reaches a generalised thermal equilibrium.
[arxiv:1403.7431]

Leda Bucciantini (Pisa U. and INFN): *Quantum quenches from excited states in the Ising chain*

We consider the non-equilibrium dynamics after a sudden quench of the magnetic field in the transverse field Ising chain starting from excited states of the pre-quench Hamiltonian. We prove that stationary values of local correlation functions can be described by the generalised Gibbs ensemble (GGE). Then we study the full time evolution of the transverse magnetisation by means of stationary phase methods. The equal time two-point longitudinal correlation function is analytically derived for a particular class of excited states for quenches within the ferromagnetic phase, and studied numerically in general. The full time dependence of the entanglement entropy of a block of spins is also obtained analytically for the same class of states and for arbitrary quenches.

11:00 - 13:05 Room B

Andrea Mezzalira (ULB, Bruxelles): *Electromagnetic response of strongly coupled plasmas*

The aim of this talk is to present a thorough analysis of the electromagnetic response of strongly coupled neutral plasmas described by the gauge/gravity correspondence based on arXiv:1404.4048.
The coupling of the external electromagnetic field with the tower of quasi-normal modes of the plasmas supports the presence of various electromagnetic modes with different properties. Among them we underline the existence of negative refraction with low dissipation for a transverse non-hydrodynamical mode. Previous hydrodynamical approaches have shown the ubiquitous character of negative refraction in charged plasmas and the absence thereof in neutral plasmas. Our results here extend the analysis for neutral plasmas beyond the hydrodynamical regime.

Luca Griguolo (Parma U.): *Supersymmetric Wilson loops and the Bremsstrahlung function in N=6 Super Chern-Simons with matter*

We introduce a class of supersymmetric Wilson loops in ABJ(M) theories, with contours lying on a two-sphere. Fermionic and bosonic degrees of freedom couple directly to the loop through a suitable super-connection. These WL generalize the familiar 1/2 BPS case, of which we briefly discuss the exact expression obtained through localization and its matrix model representation. We present the complete two-loop analysis of "latitude" loops and discuss their cohomological relation with a class of purely bosonic loop. Using the latitude, we propose an all-loop formula for the Bremsstrahlung function in ABJM theory, that is shown to be consistent with the cusp computation, both at weak and a strong coupling.

Andrea Marini (INFN - Perugia): *Holographic graphene bi-layers*

The D3/probe D5 system is one of the best studied holographic setup. It is particularly well suited for applications in condensed matter physics, since it allows to describe fundamental representation matter fields living on a 2+1-dimensional domain wall within a 3+1-dimensional gauge theory. We study a probe D5-anti-D5 pair with charge density and an external magnetic field, embedded in the AdS5XS5 background. This system provides a holographic realization of a graphene bi-layer. The magnetic field promotes a condensation of the fermions on each individual domain wall. Conversely the separation between the two probe branes promotes the fermion condensation between one wall and the other. These two effects correspond respectively to unconnected/connected configurations for the D5-anti-D5. We analyze which of these two brane configurations is the favored one at fixed values of brane separation and chemical potential.

Andrea Amoretti (Genova U.): *Coexistence of two vector order parameters: a holographic model for ferromagnetic superconductivity*

In this talk I propose a generalization of the standard holographic p-wave superconductor featuring two interacting vector order parameters. Basing our argument on the symmetry and linear response properties of the model, I propose it as a holographic effective theory describing a strongly coupled ferromagnetic superconductor. The two vector order parameters undergo concomitant condensations as a manifestation of an intrinsically interlaced electric/magnetic dynamics. Such intertwined dynamics is confirmed by the study of the transport properties. I characterize thoroughly the equilibrium and the linear response (i.e. optical conductivity and magnetic susceptibility) of the model at hand by means of a probe approximation analysis.

Flavio Porri *(SI*SSA,Trieste and INFN): *Supercurrent multiplet correlators and holography*

Correlators of gauge invariant operators provide useful information on the dynamics, phases and spectra of a quantum field theory. In this talk, I will consider N=1 supersymmetric theories and focus my attention on the supercurrent multiplet. I will give a complete characterization of two-point functions of operators belonging to such multiplet, like the energy-momentum tensor and the supercurrent, and study the relations between them. I will discuss instances of weakly coupled and strongly coupled theories, in which different symmetries, like conformal invariance and supersymmetry, may be conserved and/or spontaneously or explicitly broken. For theories at strong coupling, I will exploit AdS/CFT techniques.

16:30 - 18:35 Room A

Michele Maggiore (Genève U.): *Dark energy from non-local infrared modifications of General Relativity*

We discuss a recently developed approach to infrared modifications of GR, in which a mass term is introduced as a coefficient of nonlocal operators. We discuss conceptual aspects and cosmological consequences of the proposal. Such nonlocal theories, involving retarded propagators, must be understood as effective classical theories derived from some more fundamental (and local) QFT. The theory only involve a mass parameter m, which replaces the cosmological constant in LCDM, and is highly predictive. At the background level, after fixing m so as to reproduce the observed value of Omega_M, we get a pure prediction for the equation of state of dark energy as a function of redshift, w_{DE}(z), with w_{ DE}(0) in the range [-1.165,-1.135] as Omega_M varies over the broad range Omega_M\in [0.20,0.36]. We find that the cosmological perturbations are well-behaved, and the model fully fixes the dark energy perturbations as a function of redshift z and wavenumber k. The nonlocal model provides a good fit to supernova data and predicts deviations from General Relativity in structure formation and in weak lensing at the level of 3-4 %, therefore consistent with existing data but readily detectable by future surveys.

Michele Re Fiorentin (Southampton U.): *Strong thermal leptogenesis and the N_2-dominated scenario*

I will briefly review the main aims and concepts of leptogenesis, analysing different possible realisations. Particular attention will be devoted to the so-called N_2-dominated scenario, both in its unflavoured and flavoured versions. Its main features will be pointed out, as well as the impact of possible relevant corrections. I will then consider the conditions required by strong thermal leptogenesis, where the final asymmetry is fully independent of the initial conditions. Barring strong cancellations in the seesaw formula and in the flavoured decay parameters, I will show that strong thermal leptogenesis favours a lightest neutrino mass m_1>~ 10 meV for normal ordering and m_1>~ 3 meV for inverted ordering. Finally, I will comment on the power of absolute neutrino mass scale experiments to either support or severely corner strong thermal leptogenesis. This work is mainly based on JCAP 1403 (2014) 050

Remo Garattini (Bergamo U.): *Distorting General Relativity: Gravity's Rainbow and f(R) theories at work.*

We compute the Zero Point Energy in a spherically symmetric background combining the high energy distortion of Gravity's Rainbow with the modification induced by a f(R) theory. Here f(R) is a generic analytic function of the Ricci curvature scalar R in 4D and in 3D. The explicit calculation is performed for a Schwarzschild metric. Due to the spherically symmetric property of the Schwarzschild metric we can compare the effects of the modification induced by a f(R) theory in 4D and in 3D. We find that the final effect of the combined theory is to have finite quantities that shift the Zero Point Energy. In this context we setup a Sturm-Liouville problem with the cosmological constant considered as the associated eigenvalue. The eigenvalue equation is a reformulation of the Wheeler-DeWitt equation which is analyzed by means of a variational approach based on gaussian trial functionals. With the help of a canonical decomposition, we find that the relevant contribution to one loop is given by the graviton quantum fluctuations around the given background. A final discussion on the connection of our result with the observed cosmological constant is also reported.

Luca Visinelli (The University of Utah): *Axion cold dark matter in view of BICEP2 results*

The properties of axions that constitute 100% of cold dark matter (CDM) depend on the tensor- to-scalar ratio r at the end of inflation. If r = 0.20 as reported by the BICEP2 collaboration, then half of the CDM axion parameter space is ruled out. Namely, the Peccei-Quinn symmetry must be broken after the end of inflation, and axions do not generate non-adiabatic primordial fluctuations. The cosmic axion density is then independent of the tensor-to-scalar ratio r, and the axion mass is expected to be in a narrow range that however depends on the cosmological model before primordial nucleosynthesis. In the standard CDM cosmology, the CDM axion mass range is ma = (71 ± 2) eV (dec + 1)6/7 , where dec is the fractional contribution to the cosmic axion density from decays of axionic strings and walls.

Stefano Gariazzo (Torino U. and INFN): *Reconciling cosmology and short-baseline experiments with invisible decay of light sterile neutrinos*

It is known that there is some tension between CMB measurements and local observations in the ΛCDM model. Some examples are the counts of local galaxy clusters and the value of the Hubble parameter today: In these cases the value obtained from the fit of the CMB alone (using Planck, WMAP polarization and BICEP2 data) is in tension with the one obtained from local measurements. Moreover, short-baseline data about neutrino oscillations are well fitted if an additional sterile neutrino, with eV-scale mass, is assumed. If we consider this additional neutrino in cosmological analysis, this mass is highly incompatible with cosmological data if the sterile neutrino is fully thermalised. On the other hand, a partly thermalized neutrino would be compatible with all the data, but a partial thermalization is difficult to be achieved in the theoretical models. We introduce a cosmological invisible decay of the sterile neutrino with the eV-scale mass indicated by short-baseline neutrino oscillation experiments in order to allow its full thermalization in the early Universe and to fully reconcile these cosmological and local measurements.

16:30 - 18:35 Room B

Alessandro Pilloni (Roma U. "Sapienza" and INFN): *Multiquark hadrons as Feshbach resonances*

Since ten years ago a host of exotic resonances have challenged the ususal quarkonium picture. A number of ideas have been put forward to explain these new states, but a comprehensive framework is still missing. We estimate production cross sections at hadron colliders via MonteCarlo simulations, and show a model which explains our results in terms of Feshbach resonances.

Francesco Negro (INFN - Pisa): *Anisotropy of the quark-antiquark potential in a magnetic field*

We present the determination of the static quark anti-quark potential in the presence of an external magnetic field, by means of lattice QCD simulations. The potential shows to be different in the directions parallel and perpendicular with respect to the magnetic field, and hence non-central. In particular the string tension is larger (smaller) in the perpendicular (parallel) direction. This effect might be relevant for the modification heavy meson spectrum, in particular in the context of the phenomenology of non-central heavy ion collisions.

Argia Rubeo (Roma U. "Sapienza"): *Quark antiquark potential in a pure Yang-Mills theory*

We compute, via lattice simulations in the temporal gauge, the potential between quark and antiquark external sources in the singlet and in the adjoint representation of the color group. In particular we check the general properties of the external source potential as discussed in a recent paper by Rossi and Testa.

Michele Mesiti (Pisa U.) *Gluon Correlators in a Magnetic Background*

I will discuss the properties of the gauge invariant field strength correlators in QCD in the presence of a magnetic background. A new parametrization is proposed, which respects the symmetries of the system, and a numerical determination is obtained by Lattice QCD techniques. In this framework, a non perturbative estimate of the gluon condensate G2 can be obtained, and an increase in G2 with the magnetic field is observed.

Francesca Cuteri (U. della Calabria, Cosenza and INFN): *Flux tubes in the SU(3) vacuum: London penetration depth and coherence length*

Within the dual superconductor scenario for the QCD confining vacuum, the chromoelectric field generated by a static quark-antiquark pair can be fitted by a function derived, by dual analogy, from a simple variational model for the magnitude of the normalized order parameter of an isolated Abrikosov vortex. Previous results for the SU(3) vacuum are revisited, but here the transverse chromoelectric field is measured by means of the connected correlator of two Polyakov loops and, in order to reduce noise, the smearing procedure is used instead of cooling. The penetration and coherence lengths of the flux tube are then extracted from the fit and compared with previous results.

Friday 30

11:00 - 13:05 Room A

Michele Caselle (Torino U. and INFN): *Recent results on the effective theory of confining strings.*

The interquark potential of whatever confining gauge theory in D space-time dimensions can be described, at large quark separations, by an effective string theory. Recently two important advances improved our understanding of this effective theory. First, it was realized that the form of the effective action is strongly constrained by the requirement of the Lorentz invariance of the gauge theory, which is spontaneously broken by the formation of a long confining flux tube in the vacuum. This constraint is strong enough to fix uniquely the first few subleading terms of the action which turn out to coincide with those of the Nambu-Goto string theory. Second, it was understood how to obtain the exact Nambu-Goto spectrum by a suitable integrable perturbation of the 2d c=1 Conformal Field Theory. In this talk we first review the general implications of these two results for Lattice Gauge Theories and then, as a test of the power of these methods, use them to construct the first few boundary corrections to the effective string action.

Marco Cè (Scuola Normale Superiore, Pisa and INFN): *Testing the Witten--Veneziano mechanism with the Yang--Mills gradient flow on the lattice*

We present a precise computation of the topological charge distribution in the SU(3) Yang-Mills theory. It is carried out on the lattice with high statistics Monte Carlo simulations by employing the clover discretization of the field strength tensor combined with the Yang-Mills gradient flow. The flow equations are integrated numerically by a fourth-order structure-preserving Runge--Kutta method. We have performed simulations at four lattice spacings and several lattice sizes to remove with confidence the sistematic errors in the second (topological suceptibility \chi) and the fourth cumulant of the distribution. In the continuum we obtain \chi=185(5) MeV and the ratio between the fourth and the second cumulant R=0.233(45). Our results disfavour the \theta behaviour of the vacuum energy predicted by dilute instanton models, while they are compatible with the expectation from the large Nc expansion.

Claudio Bonati (INFN - Pisa): *The theta dependence of SU(N) gauge theories at finite temperature*

The functional dependence of free energy on the topological theta angle will be discussed in 4D SU(N) gauge theories at finite temperature and, in particular, its N dependence. The presented results, obtained by means of the lattice formulation, will provide evidence that in the confined phase the functional dependence is analogous to the zero temperature one, characterized by a large-N scaling governed by theta/N. In the high temperature deconfined phase the large-N scaling variable is instead just theta, the free energy being essentially determined by the instanton-gas approximation.

Francesco Becattini (Firenze U. and INFN): *Local thermodynamical equilibrium, beta frame and transport coefficients.*

The concept of local thermodynamical equilibrium in relativistic hydrodynamics in a quantum statistical framework is reexamined. The appropriate definition of local equilibrium naturally leads to the introduction of a relativistic hydrodynamical frame in which the four-velocity vector is the one of a relativistic thermometer at equilibrium with the fluid, parallel to the inverse temperature four-vector beta. This frame is the most appropriate for the expansion of stress-energy tensor from local thermodynamical equilibrium in a general relativistic framework with the Zubarev approach to obtain the Kubo formulae of transport coefficients.

Vito Antonelli (Milano U. and INFN): *Present and future of Neutrino physics and its role in Elementary Particle physics and Astroparticle*

Neutrino physics has a very long history of discoveries, puzzles and surprises that contributed significantly to the development of elementary particle physics and astrophysics and to the creation of a link between these two fields of research. In this talk the present situation and the possible future developments of neutrino physics are discussed, focusing the attention on two main topics: the study of solar neutrinos (a prototype of the strict interaction beteween elementary particle physics and astroparticle) and the determination of the mass hierarchy, which is one of the main open questions in this field and has a great theoretical relevance. We present the main results obtained in the last decade by solar neutrinos and mainly by Borexino (which opened the era of the sub-MeV analysis), looking at some open questions, like the metallicity problem and the detailed oscillation pattern analysis. We also discuss the future possibility to determine the mass hierarchy with new generation medium baseline reactor experiments, with particular attention to the potentialities of JUNO, an interesting new experiment under construction in China.

11:00 - 13:05 Room B

Antonio Sciarappa (SISSA, Trieste): *Supersymmetric gauge theories and quantum hydrodynamics*

We will consider the N=(2,2) ADHM gauged linear sigma model on S^2, whose target manifold in the Higgs branch describes the moduli space of k instantons for a four dimensional U(N) theory. We will show how its dual Landau-Ginzburg model in the Coulomb branch is connected to the quantum Intermediate Long Wave hydrodynamical system and how this relates to the AGT conjecture.

Laura Andrianopoli (Politecnico di Torino and INFN): *On boundary properties of gauged supergravities*

In asymptotically AdS 4D N=1 and N=2 pure supergravities, we show that the supersymmetry invariance of the action requires the addition of topological terms which generalize at the supersymmetric level the Gauss-Bonnet term. Supersymmetry invariance is achieved without requiring Dirichlet boundary conditions on the fields at the boundary, rather we find that the boundary values of the field-strengths are dynamically fixed to constant values in terms of the cosmological constant. From a group-theoretical point of view this means in particular the vanishing of the OSp(N|4)-supercurvatures at the boundary.

Alessandra Cagnazzo (DESY, Hamburg): *Dual description of Sigma Model on strongly curved supermanifolds*

To study a sigma model on a strongly curved background is a challenging task. A fact that helps us is the existence of strong-weak coupling dualities. I will present evidences for existence of a dual free field theory, focusing on the case of the three dimensional supersphere S^{3|2}. I will also comment on the nature of this free field theo

Michelangelo Preti (Parma U.): *Correlators of chiral primaries and 1/8 BPS Wilson loops from perturbation theory*

We study at perturbative level the correlation functions of a general class of 1/8 BPS Wilson loops and chiral primaries in N=4 Super Yang-Mills theory. The contours and the location of operator insertions share a sphere S^2 embedded into space- time and the system preserves at least two supercharges. We perform explicit two-loop computations, for some particular but still rather general configuration, that confirm the elegant results expected from localization procedure. We find notably full consistency with the multi-matrix model averages, obtained from 2D Yang-Mills theory on the sphere, when interacting diagrams do not cancel and contribute non-trivially to the final answer.

Marco Fazzi (Université Libre de Bruxelles): *AdS_6 solutions of type II supergravity*

There exists only one solution of massive type IIA supergravity of the form AdS_6 x M_4, which is due to Brandhuber and Oz and has M_4 = S^4. In type IIB the only solutions known so far have been constructed via abelian and nonabelian T-duality of the former. In this paper, we use the pure spinor approach to enlarge the class of IIB solutions, which includes the latter two as special cases. Our system of equations determines uniquely the form of the metric on M_4 and the internal fluxes: M_4 is an S^2 fibered over a two-dimensional space that can be explicitly determined upon solving two PDEs. We argue that our solutions can be interpreted as near-horizon limits of complicated configurations of branes, and we discuss how to introduce extra brane sources in such configurations. Our analysis could shed some new light on the mysterious five-dimensional conformal fixed point dual to these new IIB solutions.

16:30 - 18:35 Room A

Marco Mariti (Pisa U. and INFN): *Magnetic properties of the Quark Gluon Plasma.*

We study the magnetic properties of the strongly interacting matter in the range of temperatures 100-400 MeV, using Lattice QCD simulations. We introduce a new method to evaluate on the lattice the dependence of the free energy on the magnetic fields. The strongly interacting medium shows a paramagnetic behavior both in the confined and deconfined phase, with a sharp increase of the magnetic susceptibility above the deconfinement temperature. The magnetic contribution to the pressure is of the order 10-50% in the range of fields expected at LHC, eB=0.1-0.2 GeV^2.

Luigi Pilo (L'Aquila U.): *The cosmological side of massive gravity*

I review the status massive gravity with the focus on the cosmological side. Besides purely theoretical consideration, the study of massive versions of general relativity is motivated as a model of dark energy. The navigation through the various models will be guided by two basic principles : reproducing small scale tests of gravity (solar system and bellow) and the existence of sensible cosmological solutions. Form the general construction massive gravity theories with five degrees of freedom or less, based on Hamiltonian analysis, it turns out that the favored models are not nonlinear generalizations of the Fierz-Pauli theory.

Andrea Tesi (Scuola Normale Superiore, Pisa and INFN): *Higgs versus EW data: a comparison of precision tests*

Is the weak scale natural? This ever pending question makes the search for new particle production a highly motivated primary goal of the next LHC phase. These searches may or may not be successful. While waiting for a needed higher energy collider to extend the direct exploration, the search for signs of new physics might be confined to indirect tests for quite some time. In a few fully calculable models, I compare the significance to measure the Higgs couplings versus the electroweak observables.

Elena Vigiani (Pisa U. and INFN) : *Non Minimal Terms in Composite Higgs Models*

Composite Higgs Model where the Higgs is a pseudo-Goldstone boson represents, behind Supersymmetry, a natural paradigm for physics Beyond the Standard Model. The Higgs emerges as a pseudo-Goldstone boson from the spontaneous breaking of the approximate symmetry of a composite sector. In this scheme the Higgs is the analog of pions in QCD and it is naturally lighter than the other composite resonances. After reviewing some general features about Composite Higgs Models, I will introduce a general parametrization for these theories. In particular I will generalize a 4D model corresponding to the deconstruction of a 5D theory. This corresponds to the inclusion of terms allowed by the symmetries but not coming from the extra-dimensional theory. These "non minimal" terms are necessary to reproduce the most general 4D effective lagrangian compatible with the symmetries. I will study the implications for the Higgs potential and the S-parameter.

16:30 - 18:35 Room B

Antonio Gallerati (Politecnico di Torino): *Black Holes in Supergravity and Duality*

We review some recent results on stationary, asymptotically flat black hole solutions to supergravity theories and their properties with respect to the global symmetry underlying this class of solution, and manifest in their effective D=3 description. The first consists in the description of the rotation of the solution in terms of a new matrix in the algebra of the global symmetry group, similar to the Noether charge matrix. The second result is the definition of a general mathematical relation between non-extremal rotating and extremal under-rotating and static black hole solutions in D=4 supergravity. This relation is illustrated in the effective D=3 description and amounts, on a given non-extremal solution, to an Inonu-Wigner contraction of the Noether-charge matrix and of the matrix associated with rotation.

Roberto Bonezzi (Bologna U. and INFN): *Higher Spins on (A)dS in the worldline formalism*

In this talk I study the one loop effective action for a class of higher spin fields by using a first-quantized description. The latter is obtained by considering spinning particles, characterized by an extended local supersymmetry on the worldline. Quantizing the model on a circle with (A)dS target space allows us to produce a useful representation of the one loop effective action. In particular, we extract the first few heat kernel coefficients for arbitrary even spacetime dimension D and for spin S with rectangular Young tableau.

In the second part of the talk I will examine the dimensional reduction on a circle of the former model in flat space. It describes massive HS fields in odd dimensions in terms of Fierz-Pauli equations, while in the massless limit it produces a multiplet of massless fields, described by mixed symmetry Young tableaux, obeying Fronsdal-Labastida equations. The model can be consistently coupled to (A)dS spaces, although the constraint algebra becomes nonlinear.

Karapet Mkrtchyan (Scuola Normale Superiore, Pisa and INFN): *On algebras of higher spins in different dimensions*

Higher Spin algebras are at the core of the theories of Higher Spin gauge fields. We discuss Higher Spin algebras and their properties, depending on spacetime dimensions. We present explicit formulas for trace and structure constants for the Vasiliev's Higher Spin algebra, and it's generalizations.

Francesco Azzurli (Padova U.): *Classical Electrodynamics of charged massless particles.*

In this talk I will present a new class of solutions for the Maxwell equations, that describes the electromagnetic field generated by the arbitrary motion of a massless charged particle. These recent results generalize the previously known shock-wave field generated by a massless charge in rectilinear motion and show some novel features. The question about their physical meaning and their relationship with the absence of such particles in nature will be also briefly addressed.