Schedule of Talks

Talks are 55mins+5mins questions.

Week 1

Monday 10
10am: G. Festuccia, The geometry of supersymmetric partition functions
2pm: D. Martelli, Supersymmetric gauge theories on curved manifolds and their gravity duals
3.30pm-5pm: IPMU colloquium

Tuesday 11
10am: A. Tomasiello, Supersymmetry on curved spaces and holography
1:15pm-2:45pm: (Seminar Room A, MS Seminar) S. Minwalla
4pm: Y. Imamura, Factorization of S^3/Z_n partition function

Wednesday 12
10am: D. Waldram, The exceptional generalised geometry of N=2 flux backgrounds
2pm: H. Samtleben, Exceptional Form of Supergravity

Thursday 13
10am: D. Buchholz, Algebraic supersymmetry: The search for an appropriate framework
2pm: S. Carpi, Conformal nets, supersymmetry and noncommutative geometry
4pm: R. Hillier, JLO cocycles for superconformal nets

Friday 14
10am: D. Alekseevski, Cohomogeneity one Kähler and Kähler-Einstein manifolds with one singular orbit
2pm: V. Cortes, Quaternionic Kähler metrics from supergravity constructions
7pm: Workshop dinner

Week 2

Monday 17
10am: R. Suzuki, Tachyonic dilatation spectrum in the AdS/CFT correspondence via integrability
2pm: H.-Y. Chen, Integrable Structures and Dualities in Supersymmetric Gauge Theories

Tuesday 18
10am: M. Honda, Higgs branch localization of 3d N=2 theories
2pm: K. Maruyoshi, Classification of N=1 supersymmetric theories via M-theory

Wednesday 19
10am: K. Ito, Omega background and deformed BPS equations
2pm: K. Hosomichi, Self-dual strings and 2D SYM

Thursday 20
10am: L. A. Pando Zayas, Rigid Supersymmetric Backgrounds of Minimal Off-Shell Supergravity

Abstracts

Alekseevski, Dimitri

Title: Cohomogeneity one Kähler and Kähler-Einstein manifolds with one singular orbit

Abstract: We give a description of cohomogeneity one G-manifolds M of a compact semisimple Lie group G with one singular orbit which admit an invariant Kähler metric in terms of painted Dynkin diagrams (under some weak extra assumption). We give a construction of invariant Kähler and Kähler-Einsten metrics on such manifolds. The talk is based on a joint work with A. Loi and F. Zuddas

Buchholz, Detlev

Title: Algebraic supersymmetry: The search for an appropriate framework

Abstract: Bosonic as well as Fermionic symmetries can be spontaneously broken in quantum field theory. It is then impossible to describe their action on the states by Hilbert space operators (Schrödinger picture). Instead, one has to resort to describing their action on the algebra generated by the quantum fields (Heisenberg picture). Since all expectation functionals of interest appear as elements of the dual space of this algebra, one can then study their (residual) symmetry properties. This algebraic approach has been very successful in case of Bosonic symmetries and it led to deep insights (Goldstone Theorem). Its extension to Fermionic symmetries turned out to be plagued by many mathematical pitfalls, however. In this survey talk a consistent algebraic framework is presented which allows to describe and analyze supersymmetric states and functionals in quantum field theory on Minkowski space. The upshot of this analysis is the insight that supersymmetry is extremely vulnerable to thermal effects: it inevitably collapses at all non–zero temperatures. Moreover, super–KMS functionals are necessarily unbounded and therefore not suitable to describe supersymmetric thermal ensembles in the sense of van Hove. All concepts and results will be illustrated by a simple field theoretic model.

Carpi, Sebastiano

Title: Conformal nets, supersymmetry and noncommutative geometry

Abstract: In this talk I will give an introduction to some of the main ideas underlying recent results on the connection between Conformal Field Theory and noncommutative geometry, following the "noncommutative geometrization program" in the operator algebraic approach to CFT based on conformal nets, their representations (theory of superselection sectors) and supersymmetry.

Chen, Heng-Yu

Title: Integrable Structures and Dualities in Supersymmetric Gauge Theories

Abstract: In this pedagogical seminar, I will review how exact results such as partition functions as computed via localization method allow us to reveal connections between supersymmetric gauge theories in different dimensions and various quantum integrable systems. Such that dualities relating different gauge theories can also provide correspondence between distinct integrable systems.

Cortes, Vicente

Title: Quaternionic Kähler metrics from supergravity constructions

Abstract: I will focus on recent global results in special geometry. In particular, I will speak about work in progress joint with Stefan Suhr and Marc Nardmann, which implies the completeness of a large class of quaternionic Kähler metrics of negative scalar curvature. This class is of special interest in supergravity and string theory.

Festuccia, Guido

Title: The geometry of supersymmetric partition functions

Abstract: I will consider supersymmetric field theories on compact manifolds M and obtain constraints on the dependence of their partition functions Z_M on the geometry of M. For N=1 theories with a U(1) R symmetry in four dimensions, M must be a complex manifold with a Hermitian metric. In this case Z_M is independent of the metric and depends holomorphically on the complex structure moduli. I will also consider three-dimensional N=2 theories with a U(1) R symmetry, where the necessary geometric structure on M is a transversely holomorphic foliation (THF) with a transversely Hermitian metric. Again, Z_M is independent of the metric and depends holomorphically on the moduli of the THF. In examples where Z_M has been calculated explicitly, these results explain many of its observed properties.

Hillier, Robin

Title: JLO cocycles for superconformal nets.

Abstract: Superconformal nets are the basic object in an operator algebraic approach to low-dimensional supersymmetric conformal field theory. On the other hand, in operator algebras and noncommutative geometry, spectral triples and cohomological invariants like JLO cocycles have played an important role in recent years. In this talk I will explain how one can construct the latter ones out of a given general superconformal net and what information we gain. The focus shall then be on illustrating this in a few interesting settings and examples of superconformal nets: so-called N=1 superconformal nets and N=2 superconformal nets with respect to the conformal Hamiltonian, and superconformal nets with respect to the proper (translation) Hamiltonian.

Honda, Masazumi

Title: Higgs branch localization of 3d N=2 theories

Abstract: As well known, partition function of four-dimensional N=2 supersymmetric gauge theory is described by Nekrasov instanton partition function. In my talk, I will consider three dimensional N=2 theories on squashed sphere and S2xS1. Recent studies have argued that the partition functions in a class of the 3d N=2 theories have representations in terms of vortex partition functions by explicitly evaluating Coulomb branch localization formula. I will explain how we have directly derived these structures by performing Higgs branch localization in more wide class of theories.

Hosomichi, Kazuo

Title: Self-dual strings and 2D SYM

Abstract: Self-dual strings are the fundamental degree of freedom in 6D (2,0) superconformal theory. On generic Coulomb branch vacua, the strings are described by M2-branes suspended between M5-branes. We discuss the dynamics of coincident M2-branes using ABJM theory.

Imamura, Yosuke

Title: Factorization of S^3/Z_n partition function

Abstract: The path integral is widely used to compute physical quantities in quantum field theories. It is an infinite dimensional integral, and the overall normalization of the integration measure is usually neglected. However, there are cases in which the normalization becomes important. As examples of such cases, we consider gauge theories on the Lens space $L(n,1) = S^3/Z_n$, and discuss how we can fix the normalization of the partition function.

Ito, Katshushi

Title: Omega background and deformed BPS equations

Abstract: We construct N=4 super-Yang Mills theory in Omega background from dimensional reduction of ten-dimensional super Yang-Mills theory in curved background with torsion. We classify deformed supersymmetry associated with twisted N=4 supersymmetry. We also investigate the BPS equations deformed in the Omega background. In particular, we discuss the ADHM construction of instantons in the Omega background and the BPS monopole equations in the Nekrasov-Shatashvili limit.

Martelli, Dario

Title: Supersymmetric gauge theories on curved manifolds and their gravity duals

Abstract: I will overview recent results about supersymmetric field theories on curved manifolds preserving rigid supersymmetry, both in three and for four dimensions. In particular, I will discuss localised partition functions on various deformed spheres and supersymmetric indices. I will also present gravity dual solutions to large classes of such gauge theories (in the large N limit), providing non-trivial tests of the gauge/gravity duality.

The talk should be largely based on the papers:

1) Gravity duals of supersymmetric gauge theories on three-manifolds Daniel Farquet, Jakob Lorenzen, Dario Martelli, James Sparks arXiv:140x.yyyy (to appear)

2) The gravity dual of supersymmetric gauge theories on a squashed S1S3 Davide Cassani, Dario Martelli arXiv:1402.2278

3) Localization on three-manifolds Luis F. Alday, Dario Martelli, Paul Richmond, James Sparks arXiv:1307.6848

Maruyoshi, Kazunobu

Title: Classification of N=1 supersymmetric theories via M-theory

Abstract: In a past few years, a class of supersymmetric gauge theories related to M5-branes on a Riemann surface has been widely studied, related to various areas in physics and mathematics. In this talk we discuss the N=1 version of the class of theories which flow to IR N=1 superconformal fixed point, associated to a Riemann surface with additional data, after reviewing the N=2 construction. In the construction a puncture has information of a flavor symmetry of the gauge theory, and this classifies theories. We identify a duality frame where theory has a UV Lagrangian description. We also discuss dualities of this class of gauge theories.

Pando Zayas, Leopoldo A.

Title: Rigid Supersymmetric Backgrounds of Minimal Off-Shell Supergravity

Abstract: We discuss various aspects of rigid supersymmetry within minimal N=1 off-shell supergravity using the old and new minimal formulations both in Lorentzian and Euclidean signatures. In particular, we construct all rigid supersymmetry backgrounds with a hypersurface orthogonal Killing vector. In the Lorentzian signature we show that AdS_4 provides a rigid supersymmetric background in both formulations albeit with different amounts of preserved supersymmetry. In the Euclidean signature we find new backgrounds of the old-minimal supergravity, including squashed four-spheres and a half-BPS version of flat space.

Samtleben, Henning

Title: Exceptional Form of Supergravity

Abstract: Eleven-dimensional supergravity upon dimensional reduction reveals large exceptional symmetries, in accordance with the U-duality groups

of M-theory. Their higher-dimensional geometric origin has remained a mystery. I report on recent work showing that D=11 supergravity upon proper extension to an 'exceptional space-time' becomes fully covariant under the exceptional groups $E_{n(n)}$. This covariant form likewise comprises type IIB supergravity. I discuss how supersymmetry is realized on the exceptional space-time.

Suzuki, Ryo

Title: Tachyonic dilatation spectrum in the AdS/CFT correspondence via integrability

Abstract: The AdS/CFT correspondence predicts the conformal dimension of local operators in N=4 super Yang-Mills (SYM) theory in 1+3 dimensions is equal to the energy of the corresponding string states in $AdS_5 \times S^5$. We study the dimension of non-BPS determinant-like operators which should be dual to the energy of tachyonic open string states ending on a D-brane and anti-D-brane. Based on the integrability of the models, we propose boundary thermodynamic Bethe ansatz (BTBA) equations. By solving BTBA, we find an indication that SYM states become tachyonic at finite coupling where the total energy of the corresponding string becomes zero.

Tomasiello, Alessandro

Title: Supersymmetry on curved spaces and holography

Abstract: I will review recent developments on defining supersymmetric field theories on curved manifolds, with particular emphasis on superconformal theories. I will show that supercharges preserved by non-zero curvature are associated to so-called conformal Killing spinors (CKS), or twistors (in general, charged under a background gauge field). I will then relate existence of such spinors to various geometrical constraints. For example, in four euclidean dimensions, a CKS exists if and only if the manifold is complex; in four lorentzian dimensions, if and only if there exists a null conformal Killing

vector (CKV); in three lorentzian dimensions, if and only if there exists a null or timelike CKV. I will then discuss some applications of the latter result to the physics of black holes.

Waldram, Daniel J.

Title: The exceptional generalised geometry of N=2 flux backgrounds

Abstract: It is well known that for purely gravitational backgrounds, supersymmetry implies special holonomy. I will discuss the corresponding "generalised geometry" of generic supergravity flux backgrounds preserving eight supercharges. I first review the reformulation of eleven-dimensional supergravity in terms of an extended tangent space with an $E_{d(d)}$ structure group and a generalised analogue of the Levi-Civita connection. I then show how this can be used to formulate supersymmetric backgrounds in terms of integrable structures on the generalised tangent space. We find the generalisations of the CalabiYau integrability conditions appear very naturally as an infinite dimensional hyper-Kahler quotient.