Geometry of String and Gauge Theories

Report of Contributions

Contribution ID: **1**   Type: **not specified**

Three Remarks On d=4 N=2 Field Theories

Monday 10 July 2017 10:00 (1 hour)

Remarks 1 and 2 focus on half-BPS line defects in four-dimensional field theories with N=2 supersymmetry. Remark 1 concerns a minor, but intriguing, gap in the classification of line defects in Lagrangian theories of class S. Remark 2 concerns computations of "VEV's" of line defects on R3 x S1. Remark 3 discusses some hypothetical new N=2 d=4 superconformal theories.

Presenter: MOORE, Gregory (Rutgers University)

Contribution ID: **2**   Type: **not specified**

2d (0,2) Brane Brick gauge theories

Monday 10 July 2017 15:00 (1 hour)

Brane Brick models are 2d (0,2) gauge theories on the world-volume of D1-branes probing toric Calabi-Yau (CY) 4-fold singularities. Given a toric diagram, we can construct the gauge theory by orbifolding, partial resolution, or other means. For abelian theories, we can verify that the classical moduli space coincides with the CY geometry, most efficiently by using a combinatorial tool called brick matching. The map between gauge theory and geometry is in general many to one. In some concrete examples, we show that the gauge theories corresponding to the same geometry are related to each other via Gadde-Gukov-Putrov triality. One way to understand the triality is to study the mirror dual of the toric CY singularity. Mirror symmetry leads to a geometric unification of dualities in different dimensions, where the order of duality is (n-1) for a CY n-fold. At the quantum level, we expect that the abelian theory will flow to a sigma model on the CY singularity with the left-moving fermions transforming in the 6 representation of the SU(4) holonomy group of the tangent bundle. We confirm this expectation by computing the elliptic genus of the gauge theory.

Presenter: LEE, Sangmin (Seoul National University)

Contribution ID: **3**
Type: **not specified**

Song

Presenter: SONG, Jaewon (Korea Institute for Advanced Study)

Contribution ID: 4   Type: **not specified**

Refined BPS invariants of 6d SCFTs from anomalies and modularity

Tuesday 11 July 2017 10:00 (1 hour)

The last few years have witnessed a renewed interest in six dimensional quantum theories, some 20 years after the existence of non-trivial conformal fixed points for such theories was first argued for. 6d theories generically contain strings in their spectrum and require novel field theoretic tools for their description. In this talk, we will discuss how the spectrum arising from quantization of the 6d string is captured by the topological string. We will argue that knowledge of the anomaly polynomial implies the holomorphic anomaly equation governing the topological string, and use the latter in conjunction with modularity properties to solve for the partition function exactly order by order in the number of strings.

Presenter: KASHANI-POOR, Amir-Kian

Contribution ID: **5** Type: **not specified**

Anyons and 3d dualities

Tuesday 11 July 2017 15:00 (1 hour)

Recent studies of Chern-Simons-Matter (CSM) theories have unveiled an infinite web of dualities among these theories. While consistency within the web provides strong evidence for the dualities over a range of parameters, few explicit checks go beyond the strict infinite N limit. In this talk I will briefly review this web of dualities and some of the tests it has been subjected to. I will then advocate the study of CSM theories in the non-relativistic regime where they describe (strongly) interacting anyons in a trap. In this regime some observables can be evaluated exactly providing further evidence for the aforementioned dualities.

Presenter: Dr DOROUD, Nima (Sissa)

Contribution ID: **6**
Type: **not specified**

Cardy Formula for SUSY Theories and Localization

Tuesday 11 July 2017 16:00 (1 hour)

I will consider 4d N=1 supersymmetric theories on a compact Euclidean manifold of the form S1×S3. Taking the limit of shrinking S1, I will present a formula for the limit of the localization integrand, derived by simple effective theory considerations. The limit is given in terms of an effective potential for the holonomies around the S1, whose minima determine the asymptotic behavior of the partition function. If the potential is minimized in the origin, where it vanishes, the partition function has a Cardy-like behavior fixed by Tr(R), while a nontrivial minimum gives a shift in the coefficient. I will also discuss the generalization to 6d N=(1,0) indices and an application to Schur indices.

Presenter: DI PIETRO, Lorenzo (Perimeter Institute)

Contribution ID: **7**　　　　　　　　　　　　　　　　　　Type: **not specified**

N=1 "Lagrangians" for N=2 "non-Lagrangian" theories

Wednesday 12 July 2017 10:00 (1 hour)

Argyres-Douglas (AD) theory is an N=2 superconformal field theory (SCFT) which has no weak-coupling limit. Nevertheless, AD theory is believed to be the simplest interacting N=2 SCFT. In this talk, I will present N=1 gauge theories that flow to the AD theory and its generalizations in the IR. This high-energy description of the AD theory makes it possible to compute supersymmetric partition functions. This gauge theory is obtained from certain N=1 preserving deformation of an N=2 SCFT. I will discuss special cases where N=1 deformation of the N=2 theory leads to an enhanced N=2 supersymmetry in the IR.

Presenter:　SONG, Jaewon (Korea Institute for Advanced Study)

Contribution ID: **8**   Type: **not specified**

d=4 N=2 Field Theory And Physical Mathematics

Wednesday 12 July 2017 14:00 (1 hour)

[Colloquium.] I will explain the meaning of the two phrases in the title. Much of the talk will be a review of the renowned Seiberg-Witten formulation of the low-energy physics of certain four dimensional supersymmetric interacting quantum field theories. In the latter part of the talk I will briefly describe some of the significant progress that has been made in solving for the so-called BPS sector of the Hilbert space of these theories. Investigations into these physical questions have had a nontrivial impact on mathematics.

Presenter: MOORE, Gregory (Rutgers University)

Contribution ID: **9**   Type: **not specified**

D-brane masses and the motivic Hodge conjecture

Thursday 13 July 2017 10:00 (1 hour)

We calculate the masses of the D2 and and D4 brane at the conifold of one parameter Calabi-Yau spaces, using the motivic Hodge conjecture. This gives evidence for the latter in a new context.

Presenter: KLEMM, Albrecht (Institut fuer Theoretische Physik)

Contribution ID: **10**

Type: **not specified**

Genus zero log BPS numbers for del Pezzo surfaces

Thursday 13 July 2017 15:00 (1 hour)

We study the enumerative relationship between local and log Calabi-Yau geometries for del Pezzo surfaces. Genus zero log BPS numbers for del Pezzo surfaces are defined from the log Calabi-Yau geometry of the surface with a smooth anticanonical divisor. We propose their conjectural relationship to the genus zero local BPS state counts. This talk is based on joint work with Michel van Garrel, Sheldon Katz and Nobuyoshi Takahashi.

Presenter: CHOI, Jinwon (Sookmyung Women's University)

Contribution ID: **11**   Type: **not specified**

Two Gauged Linear Sigma Models for non-spherical Calabi-Yau manifolds

Thursday 13 July 2017 16:00 (1 hour)

I will describe two GLSMs with gauge group U(2), that help to understand geometry of a hyper-kähler 4-fold and of an abelian surface (varieties of lines on del Pezzo manifolds). By RG flow one can relate sigma-models on these CYs to "symmetric squares" of smaller theories, despite the fact that for very general cubic fourfold its variety of lines is not birational to a Hilbert scheme of a K3 surface.

Presenter: GALKIN, Sergey (National Research University Higher School of Economics)

Contribution ID: **12**   Type: **not specified**

3d N=2 dualities with monopole superpotentials

Friday 14 July 2017 10:00 (1 hour)

In this talk I will discuss 3d gauge theories with monopole operator entering the superpotential. Starting with the theory without monopole potential, if the monopole potential is relevant there is an RG flow to the monopole-deformed theory. Here, focusing on U(Nc) SQCD with Nf flavors and N=2 supersymmetry, I will argue that even when the monopole potential is irrelevant, the monopole-deformed theory can exist and admit an Aharony-like dual description. I will present various checks and generalizations of this duality.

Presenter: PASQUETTI, Sara (University of Milan-Bicocca)

Contribution ID: **13**
Type: **not specified**

Stable quotients and holomorphic anomaly equation

Friday 14 July 2017 15:00 (1 hour)

I will prove the holomorphic anomaly equation for stable quotient invariant of local P2. This equation is in the precise form predicted by B-model physics. If I have more time, I will also explain about the holomorphic anomaly equation for [C3/Z3] and formal quintic invariants. This talk is based on joint work with Rahul Pandharipande.

Presenter: LHO, Hyenho (ETH Zurich)

Contribution ID: 14   Type: **not specified**

Squashed toric sigma models and mock modular forms

Monday 17 July 2017 10:00 (1 hour)

In the late 80s and early 90s a three-way link was established between N=(2,2) SCFTs, compact Calabi Yau (CY) manifolds, and modular/Jacobi forms. These links can be understood through the corresponding Gauged Linear Sigma Models and calculations of their elliptic genera. I will discuss how there are interesting modifications to these links when the spectrum involves a continuum. The corresponding players in the new relations are non-compact N=(2,2) SCFTs, squashed toric manifolds, and mock modular/mock Jacobi forms.

Presenter: MURTHY, Sameer (King's College London)

Contribution ID: **15**   Type: **not specified**

The infrared physics of bad theories

Monday 17 July 2017 15:00 (1 hour)

Three-dimensional gauge theories with eight supercharges (3d N=4) have a rich moduli space of supersymmetric vacua with different low energy physics. This infrared physics is well understood for theories with large enough number of flavours ("good theories"), but less so if the number of flavours is small ("bad theories"). In this talk I will focus on 3d N=4 super-QCD theories with U(N) gauge group and N_f flavours of fundamental hypermultiplets. After reviewing known results and puzzles about such theories, I will discuss their quantum corrected moduli space of vacua, which consists of Higgs, Coulomb and mixed branches, and their low energy physics as N and N_f are varied. As a by-product, I will clarify if and in which sense bad U(N) gauge theories with N_f >= N flavours flow to their "Seiberg dual" good U(N_f-N) theories with N_f flavours (plus free fields) at low energies, as is suggested by localization results.

Presenter: Dr CREMONESI, Stefano (Durham University)

Contribution ID: **16**　　　　　　　　　　　　　　　　　　Type: **not specified**

Witten index for noncompact dynamics

Monday 17 July 2017 16:00 (1 hour)

Many of the gauged dynamics motivated by string theory come with gapless asymptotic directions. In this talk, we focus on d=1 GLSM's of such kind and their Witten indices, having in mind of the associated D-brane bound state problems. Upon illustrating by examples that twisted partition functions can be misleading, we proceed to explore how physical Witten indices can sometimes be embedded therein. There arise further subtleties when gapless continuum sectors come from a gauge multiplet, as in pure Yang-Mills or non-primitive quiver theories. For such theories, the twisted partition functions tend to involve fractional expressions. We point out that these are tied to the notion of rational invariant in the wall-crossing formulae, offering a general mechanism of extracting the Witten index directly from the twisted partition function.

Presenter:　LEE, Seung Joo (Virginia Tech)

Contribution ID: **17**   Type: **not specified**

All-Order Volume Conjecture for Closed 3-Manifolds from Complex Chern-Simons Theory

Tuesday 18 July 2017 10:00 (1 hour)

Abstract: I'll review some general aspects of complex Chern-Simons theory on hyperbolic 3-manifolds, focusing on the case of gauge group G=SL(2,C). After a brief introduction to the Volume Conjecture (VC), for knot complements and, a very recent mathematical proposal, for closed hyperbolic 3-manifolds, I'll show how complex Chern-Simons theory is related with them and how this connection leads to a novel generalization of the most recently proposed VC for closed 3-manifolds.

Presenter: ROMO, Mauricio (IAS)

Contribution ID: **18** Type: **not specified**

Supersymmetric partition function and higher dimensional A-twist

Tuesday 18 July 2017 15:00 (1 hour)

I will talk about three-dimensional N=2 supersymmetric gauge theories on M_{g,p}, a circle bundle of degree p over a genus g Riemann surface. We compute the supersymmetric partition functions on M_{g,p} and correlation functions of BPS loop operators. We also consider four-dimensional uplift of this construction, which computes the generalized index of N=1 gauge theories defined on elliptic fibration over genus g Riemann surface. We find that the partition function or index can be written as a sum over "Bethe vacua" of two-dimensional A-twisted theory obtained by compactification. With this framework, we will see how the partition functions on manifolds with different topologies are related to each other. It also provides a novel tool to study various supersymmetric dualities, which allows us to study the action of the dualities on the co-dimension two BPS operators.

Presenter: KIM, Heeyeon (Perimeter Institute)

Contribution ID: **19**   Type: **not specified**

Modular Constraints on Conformal Field Theories with Currents

Tuesday 18 July 2017 16:00 (1 hour)

Using the modular bootstrap, we study the constraints on the spectrum of c>1 unitary two-dimensional conformal field theories with holomorphic currents. Imposing a gap in the twist, we obtain the numerical upper bound on conformal dimension of the lowest primary states. We find that diverse rational conformal field theories are realized on the numerical boundary, including the level-1 Wess-Zumino-Witten models for Deligne's exceptional Lie algebras and cousins of the extremal conformal field theories. Their low-lying spectrum and corresponding degeneracies are numerically analyzed, this enable us to confirm the structure of modular invariant partition function via Virasoro character decomposition. We also extend this analysis to the rank-k W-algebra case, the numerical test suggest that the unitary irreducible representations are allowed only for c>=k.

Presenter: BAE, Jin-Beom (Korea Institute for Advanced Study)

Contribution ID: **20**   Type: **not specified**

Dimensional reduction and dualities in two dimensions

Wednesday 19 July 2017 10:00 (1 hour)

We discuss the reduction of supersymmetric theories to two dimensions, and new features that arise here, including non-trivial target space metrics and the appearance of direct sums of decoupled theories. We describe how these features affect the reduction of supersymmetric dualities, and point out new subtleties that arise in two dimensional infrared dualities. In the process, we recover many known dualities, and find some new ones.

Presenter: WILLETT, Brian (Kavli Institute for Theoretical Physics, UC Santa Barbara)

Contribution ID: **21**   Type: **not specified**

Dualities and exact results in 3d supersymmetric gauge theories

Wednesday 19 July 2017 14:00 (1 hour)

[Colloquium.] Dualities give us new perspectives on the dynamics of supersymmetric gauge theories and are valuable tools to explore the strongly coupled phases. We know different types of dualities such as holographic, UV and IR dualities and various examples of correspondences relating supersymmetric gauge theories to lower-dimensional theories such as 2d CFTs. Over the last 10 years the application of the localization technique to supersymmetric theories defined on compact spaces in various dimensions has allowed us to calculate exactly partition functions and correlators and to perform non-trivial tests of previously conjectured dualities and to discover new ones. I will review various types of IR dualities for 3d supersymmetric theories and discuss the strategies to test them. I will then propose a new family of IR dualities involving theories with monopole operators deformations entering the superpotential. I will argue that monopole deformed theories can exits even if the monopole deformation is irrelevant at the IR fixed point of the undeformed theory.

Presenter: PASQUETTI, Sara (University of Milan-Bicocca)

Contribution ID: **22**

Type: **not specified**

Gauged Linear Sigma Models, Calabi-Yaus and Hemisphere Partition Function

Thursday 20 July 2017 10:00 (1 hour)

The gauged linear sigma model (GLSM) is a supersymmetric gauge theory in two dimensions which captures information about Calabi-Yaus and their moduli spaces. Recent results in supersymmetric localization provide new tools for computing quantum corrections in string compactifications. This talk will focus in particular on the hemisphere partition function of the GLSM which computes the quantum corrected central charge of B-type D-branes. Several concrete examples of GLSMs and applications of the hemisphere partition function in the context of transporting D-branes in the Kahler moduli space will be given.

Presenter: KNAPP, Johanna (TU Wien)

Contribution ID: **23**   Type: **not specified**

Multiple Fibrations, CICYs and Dualities

Thursday 20 July 2017 15:00 (1 hour)

It is an often noted fact that the vast majority of known Calabi-Yau geometries admit a genus one fibration. I will investigate this in the context of Calabi-Yau described as complete intersections in products of projective spaces, as well as extensions of that construction. The vast majority of these manifolds admit a large number of different fibrations. We will use this structure to describe links and dualities between theories obtained via different F-theory compactifications.

Presenter: GRAY, James (Virgina Tech)

Contribution ID: 24

Type: **not specified**

RG Flows Across Dimensions and Holography

Thursday 20 July 2017 16:00 (1 hour)

Abstract: Superconformal field theories placed in nontrivial background fields for the metric and the continuous global symmetries exhibit a rich web of RG flows across dimensions. I will discuss several examples of such flows and emphasize some of their universal features. In addition, I will employ non-perturbative tools such as 't Hooft anomaly matching, a-, F-, and c-extremization, and holography to gain a quantitative understanding of some aspects of these theories. Finally, I will discuss the relevance of these results for a microscopic understanding of the entropy of supersymmetric black holes and strings in AdS.

Presenter: BOBEV, Nikolay (KU Leuven)

Contribution ID: **25**   Type: **not specified**

Borel resummation and perturbative series in supersymmetric gauge theories

Friday 21 July 2017 10:00 (1 hour)

Perturbative series in quantum field theory is typically divergent.
There is a standard way to resum divergent series called Borel resummation. While perturbative series in typical field theory is expected to be non-Borel summable, it is natural to ask when perturbative series is Borel summable and if it is non-Borel summable, what is a correct way to resum the perturbative series. In my talk I will first discuss that we can show Borel summability of perturbative series in 4d N=2 and 5d N=1 supersymmetric gauge theories with Lagrangians for various observables. It turns out that exact results in these theories can be obtained by summing over the Borel resummations with every instanton number. I also discuss perturbative series in general 3d N=2 supersymmetric Chern-Simons matter theory, which is given by a power series expansion of inverse Chern-Simons levels. We prove that the perturbative series are always Borel summable along imaginary axis. It turns out that the Borel resummations along this direction are the same as exact results. I will also give physical interpretations of singularities in Borel plane for this class of theories. [PRL116,no.21,211601(2016), PRD94, no.2, 025039 (2016) and upcoming paper(s)]

Presenter: HONDA, Masazumi (Weizmann Institute of Science)

Contribution ID: 26

Type: **not specified**

F-theory and AdS_3/CFT_2

Friday 21 July 2017 15:00 (1 hour)

I will discuss supersymmetric AdS_3 solutions in F-theory, that is Type IIB supergravity with varying axio-dilaton, which are holographically dual to 2d N=(0,4) superconformal field theories with small superconformal algebra. The aim of this work is to set up holography in the context of F-theory, which are traditionally two distinct areas of string theory. The talk will be based on the arXiv paper 1705.04679.

Presenter: MARTELLI, Dario (King's College London)