Fields and Duality 2017
Munich, ASC

	Mon 09 Oct	Tue 10 Oct	Wed 11 Oct	Thu 12 Oct	Fri 13 Oct
9.00	Assel	Beem	Dimofte	Gukov	Tomasiello
10.30	Prochazka	Heckman	Closset	Nekrasov	Gukov
Lunch break					
13.30	Bullimore	Razamat	Le Floch	Dimofte	
15.00		Zaffaroni	Yoshida	Manschot	
18.00				conference dinner	

Speaker	**Titel**
Benjamin Assel (CERN)	The infrared fixed points of bad theories
Christopher Beem (Oxford U.& IAS Princeton)	Comments on Vertex Operator Algebras for N=2 SCFTs
Mathew Bullimore (Oxford U.)	Twisted Hilbert Space of 3d Supersymmetric Gauge Theories
Cyril Closset (CERN)	Supersymmetric partition functions and the A-model
Tudor Dimofte (UC Davis & Perimeter)	Dual boundary conditions for 3d N=2 gauge theories
Bruno Le Floch (Princeton U.)	Orbifolds of 4d N=2 supersymmetric gauge theories
Sergei Gukov (Caltech)	Topological twists of non-Lagrangian theories
Jonathan Heckman (North Carolina U.)	6D Fractional Quantum Hall Effect
Jan Manschot (Trinity Coll. Dublin)	Topological partition functions and (iterated) integrals of modular forms
Nikita Nekrasov (SUNY Stony Brook)	Gauge origami
Tomas Prochazka (LMU Munich)	Webs of W algebras
Shlomo Razamat (Technion)	E-string theory on Riemann surfaces
Alessandro Tomasiello (INFN Milano)	Six-dimensional CFTs and M5-branes
Yutaka Yoshida (Kyoto U.)	Vortices , wall-crossing and 3d Seiberg like dualities
Alberto Zaffaroni (INFN Milano)	Localization and entropy counting

Abstracts

Benjamin Assel: The infrared fixed points of bad theories

I will present a new approach to study the RG flow in 3d N=4 gauge theories, based on an analysis of the Coulomb branch of vacua, focusing on U(N) SQCD theories with fundamental matter. The Coulomb branch is described as a complex algebraic variety and important informations about the strongly coupled fixed points of the theory can be extracted from the study of its singularities. I will use this framework to revisit and clarify the classification of infrared fixed points in U(N) SQCD with different amounts of matter hypermultiplets, in particular for the so called ``bad'' theories.

Mathew Bullimore: Twisted Hilbert Space of 3d Supersymmetric Gauge Theories

I will discuss aspects 3d N = 2 gauge theories on R x C with topological twist on a Riemann surface C in terms of a supersymmetric quantum mechanics on R. I will focus on a mathematical description of the Hilbert space of supersymmetric ground states, from which the twisted index can be recovered as a graded trace. I will consider the simplest abelian examples and demonstrate invariance of the Hilbert space of supersymmetric ground states under three-dimensional mirror symmetry. This is work in progress with A. Ferrari.

Christopher Beem: Comments on Vertex Operator Algebras for N=2 SCFTs

Every N=2 SCFT in four dimensions comes equipped with a vertex operator algebrathat encodes the spectrum and OPE coefficients of an infinite class of 1/4 BPS operators knownas Schur operators. I will discuss a number of results as well as open questions regarding thestructural properties of the VOAs that appear in this correspondence and their relationship to four-dimensional physics. I will discuss a proposal for how to recover of the Higgs branch ofvacua from the VOA and the consequences of this proposal for the behaviour of Schur super-conformal indices under modular transformations. This leads to a surprising relationship between the a-type Weyl anomaly coefficient and the spectrum of surface operators in an N=2 SCFT.

Cyril Closset: Supersymmetric partition functions and the A-model
I will present recent results about supersymmetric partition functions of 3d N=2 and 4d N=1 supersymmetric gauge theories with an R-symmetry. Many partition function functions on half-BPS geometric backgrounds can be viewed as expectation values of codimension-2 half-BPS defect operators on C*S^1 (in 3d) or C*T^2 (in 4d), with C a Riemann surface. This approach greatly simplifies previous computations, and leads to new results.

Tudor Dimofte: Dual boundary conditions for 3d N=2 gauge theories
The talks will focus on half-BPS boundary conditions for 3d N=2 gauge theories that preserve 2d N=(0,2) supersymmetry. I will review (and extend) the classification of such boundary conditions and the BPS local operators living on them, which form chiral algebras. I define a half-index that counts boundary local operators, or equivalently computes a character of the boundary chiral algebra. With the help of the half-index and some physical intuition, I will identify the action on boundary conditions of some basic dualities, including ``mirror symmetries'' and level-rank dualities. This in turn leads to a definition of duality interfaces. (Work in progress with D. Gaiotto and N. Paquette.)

Bruno Le Floch: Orbifolds of 4d N=2 supersymmetric gauge theories
After recalling how some 4d N=2 gauge theories arise from reductions of 6d N=(2,0) superconformal theories on a Riemann surface, I will discuss two discrete quotients with codimension 2 orbifold singularities. In the first case the orbifold acts by rotations around one plane of the 4d N=2 theory; this is related to a Gukov-Witten surface operator that imposes a monodromy around that plane. We deduce instanton partition functions in the presence of surface operators; interestingly, instantons can fractionalize. In the second case the orbifold acts by reflection on the 4d theory and the Riemann surface. We learn how boundaries are encoded in the AGT correspondence. We are led to consider 4d N=2 quiver theories where some vector multiplets live on a hemisphere and others on a projective space.

Jan Manschot: Topological partition functions and (iterated) integrals of modular forms
As a consequence of electric-magnetic duality, partition functions of four-dimensional gauge theories can be expressed in terms of modular forms in many cases. I will discuss new results for the modularity of topologically twisted partition functions of N=2 and N=4 supersymmetric theories, and in particular how these partititon functions may involve (iterated) integrals of modular forms.

Nikita Nekrasov: Gauge origami
The gauge origami are the statistical mechanical models which arise from supersymmetric localisation of gauge theory path integrals. I will describe the gauge theory problems which lead to these models, and time permitting will explain the connection to quantum algebras and integrable systems.

Sergei Razamat: E-string theory on Riemann surfaces
We study compactifications of the 6d E-string theory, the theory of a small E_8 instanton, to four dimensions. In particular we identify N=1 field theories in four dimensions corresponding to compactifications on arbitrary Riemann surfaces with punctures and with arbitrary non-abelian flat connections as well as fluxes for the abelian sub-groups of the E_8 flavor symmetry. This sheds light on emergent symmetries in a number of 4d N=1 SCFTs (including the `E7 surprise' theory) as well as leads to new predictions for a large number of 4-dimensional exceptional dualities and symmetries.

Alessandro Tomasiello: Six-dimensional CFTs and M5-branes
I will review some recent progress on six-dimensional conformal field theories, highlighting applications to the dynamics of M5-branes. On an orbifold singularity, M5s can fractionate, and they can recombine by sometimes leaving behind a 'frozen' version of the singularity. The CFTs describing these processes also happen to be ubiquitous building blocks for more complicated ones. There is also evidence for other processes where branes recombine in patterns associated to nilpotent orbits of Lie groups, with precise checks obtained by anomalies and moduli space dimensions.

Yutaka Yoshida: Vortices , wall-crossing and 3d Seiberg like dualities
We explore 1d vortex dynamics of 3d supersymmetric Yang-Mills theories, as inferred from factorization of exact partition functions. Under Seiberg-like dualities, the 3d partition function must remain invariant, yet it is not a priori clear what should happen to the vortex dynamics. We observe that the 1d quivers for the vortices remain the

same, and the net effect of the 3d duality map manifests as 1d Wall-Crossing phenomenon; Although the vortex number can shift along such duality maps, the ranks of the 1d quiver theory are unaffected, leading to a notion of fundamental vortices as basic building blocks for topological sectors. For Aharony-type duality, in particular, where one must supply extra chiral fields to couple with monopole operators on the dual side, 1d wall-crossings of an infinite number of vortex quiver theories are neatly and collectively encoded by 3d determinant of such extra chiral fields.

Alberto Zaffaroni: Localization and entropy counting

I discuss how localization techniques for three and four-dimensional supersymmetric gauge theories can lead to a microscopic entropy counting for AdS black holes.