FRG Conference on Topology and Field Theories
June 4 - 8, 2012
University of Notre Dame, USA

BOOK OF ASTRACTS

Speakers

David Ayala (Harvard University)
Daniel Berwick-Evans (University of California - Berkeley)
Ulrich Bunke (University of Regensburg, Germany)
Kevin Costello (Northwestern University)
Ryan Grady (University of Notre Dame)
Sergei Gukov (California Institute of Technology)
André Henriques (UIUC)
Joseph Hirsh (CUNY)
Jacob Lurie (Harvard University)
Dmitri Pavlov (University of Müenster)
Kate Poirier (University of California - Berkeley)
Daniel Pomerleano (University of California - Berkeley)
Arturo Prat-Waldron (MPIM Bonn, Germany)
Chris Schommer-Pries (MIT)
Dennis Sullivan (CUNY and SUNY - Stony Brook)
Scott Wilson (CUNY)

David Ayala (Harvard University)
Higher categories are sheaves on manifolds
Abstract: Chiral/factorization homology gives a procedure for constructing a topological field theory from the data of an E_n algebra. I'll explain a mulit-object version of this construction which produces a topological field theory from the data of an n-category with adjoints. This construction is a consequence of a more primitive result which asserts an equivalence between n-categories with adjoints and "transversality sheaves" on framed n-manifolds - of which there is an abundance of examples. This work is joint with Nick Rozenblyum.

Daniel Berwick-Evans (University of California - Berkeley)
Spaces of field theories and the topology of manifolds
Abstract: We will explain a way in which geometric field theories can be used to study the topology of manifolds. After setting up the main players as defined by Stolz and Teichner, we'll focus attention on dimensional reduction and quantization. The former allows us to extract numerical invariants whereas the latter can be used to produce a linear approximation (in the sense of Goodwillie calculus) that builds a cohomology theory out of a space of twisted field theories.

Ulrich Bunke (University of Regensburg, Germany)
Bordism, K-theory and eta invariants
Abstract: I will describe and compare homotopy theoretic and analytic constructions of K-theory based invariants detecting torsion elements in bordisms groups. In the case of string bordism I will explain an example of such an invariant which factorizes over the string orientation of topological modular forms. Is time permits I will explain a new version of Chern-Weyl theory based on differential K-theory which is useful to derive intrinsic expressions for the bordism invariants mentioned above.

Kevin Costello (Northwestern University)
Supersymmetric gauge theory and derived geometry
Abstract: Most mathematical work on supersymmetric gauge theories has been through their topological twists. These lectures will be about partially-twisted supersymmetric gauge theories, which are closer to the full physical theory. These partial twists have natural interpretations in terms of derived moduli of bundles.
Lecture 1: Classical field theories in the BV formalism
Lecture 2: Supersymmetry and twisting; description of minimally twisted supersymmetric gauge theories.
Lecture 3: Supersymmetric gauge theory and the Yangian

Ryan Grady (University of Notre Dame)
Observables and Index Theorems
Abstract: The story of quantum field theory and index theory is of a happy marriage going back at least to the 1980's. In this talk we give a status report of a perturbative approach to the algebraic index theorem (and further the analytic index theorem). The key ingredient is the factorization algebra of observables in a one-dimensional Chern- Simons theory. This talk is based on joint work with Owen Gwilliam.

Sergei Gukov (California Institute of Technology)
What A-polynomial knows about Khovanov homology
Abstract: TBA

André Henriques (UIUC)
TBA
Abstract: TBA

Joseph Hirsh (CUNY)
Deformations with noncommutative parameters
Abstract: In this talk I will describe the classical yoga of deformation theory—that commutative moduli problems are locally described by dgLie algebras—and provide some examples. Then, importing tools from operad theory, most notably Koszul Duality, I will describe a generalization that classifies the local structure of noncommutative moduli problems. I will conclude by describing some ongoing work to exploit the relationship between noncommutative deformation theory and Goodwillie's calculus of functors.

Jacob Lurie (Harvard University)
Loop Spaces, p-Divisible Groups, and Character Theory
Abstract: Let G be a finite group. One of the main theorems of representation theory asserts that the construction which assigns to each representation of G its character induces an isomorphism between the representation ring of G and the ring of conjugation-invariant functions on G. This isomorphism can be interpreted as giving a concrete description of the G-equivariant K-theory of a point "with complex coefficients". Hopkins, Kuhn, and Ravenel developed an analogous "character theory" for a large class of cohomology theories, known as Morava E-theories. In this talk, I'll review the work of Hopkins-Kuhn-Ravenel, describe an extension of it, and indicate briefly how this extension can be used to produce examples of topological quantum field theories.

Dmitri Pavlov (University of Müenster)
Differential cohomology and smooth topological field theories
Abstract: We will discuss a characterization of differential cohomology and related functors in terms of topological field theories fibered over the site of smooth manifolds. This can be seen as the first step toward a smooth version of the cobordism hypothesis. Joint work in progress with Daniel Berwick-Evans, Stephan Stolz, and Peter Teichner.

Kate Poirier (University of California - Berkeley)
Compactifying String Topology
Abstract: String topology studies the algebraic topology of the free loop space of a closed, oriented manifold. Previous treatments of string topology describe algebraic structures on the homology of the free loop space of the manifold and operations parameterized by a noncompact space of graphs. One perspective is that these structures should be a shadow of a richer structure at the chain level and that the space parametrizing the operations should be compactified. In this talk, we describe the compact space of graphs giving string topology operations on the singular chains of the free loop space which induce known operations on homology. This is joint work with Nathaniel Rounds.

Daniel Pomerleano (University of California - Berkeley)
Curved String Topology and Fukaya Categories
Abstract: In this talk, we will look at non-commutative versions of Landau-Ginzburg models. More precisely, given a simply connected manifold M such that its cochain algebra, $C^*(M)$, is a pure Sullivan dga, we will consider curved deformations of the algebra of chains on its loop space $C_*(\Omega(M))$ and consider when the category of curved modules over these algebras becomes fully dualizable. For simple manifolds, like products of spheres, we are able to give an explicit criterion, like the Jacobian criterion, for when the resulting category of curved modules is smooth, proper and CY and thus gives rise to a TQFT. We give Floer theoretic interpretations of these theories for projective spaces and their products, which involve defining a Fukaya category which counts holomorphic disks with prescribed tangencies to a divisor.

Arturo Prat-Waldron (MPIM Bonn, Germany)
On the Construction of the Dirac Operator via Geometric Quantization of Supermanifolds
Abstract: In this talk we discuss the geometric quantization of a certain symplectic supermanifold obtained from considering a one-dimensional supersymmetric sigma model on a Riemannian manifold. We study the relation between the metaplectic correction in the super-setting and spin structures and we construct the heat kernel of the Dirac operator of a spin manifold by quantizing an appropriate symmetry of the system using a supersymmetric version of the Blattner-Kostant-Sternberg pairing. We explain how this point of view fits into the Stolz-Teichner program of studying cohomology theories via super-symmetric field theories.

Chris Schommer-Pries (MIT)
The unicity of the homotopy theory of higher categories.
Abstract: We will describe recent joint work with Clark Barwick in which we provide a complete axiomatization of the homotopy theory of (infty,n)-categories. The space of theories satisfying our axioms is a $B(Z/2)^n$ and includes the models of Barwick, Bergner, Joyal, Kan, Lurie, Rezk, and Simpson, among others. This generalizes a theorem of Toën when n = 1, and it verifies two conjectures of Simpson.

Dennis Sullivan (CUNY and SUNY Stony Brook)
Some solved and unsolved puzzles in the FRG's focus on 2D field theories
Abstract: The talk will comment on kontsevich's result and lurie's result in 2D, the characterization problem related to the harmonic compactification of moduli space and results from transversal string topology.

Scott Wilson (CUNY)
Chern-Simons forms, Free Loop Spaces, and K-theory
Abstract: A Chern-Simons form, associated to a path of connections on a bundle, is in fact the shadow of a certain equivariant form on the free loop space of the base. The latter mediates between Bismut-Chern forms, whose role in low dimensional TFT's has been explained by Han, Stolz and Teichner.

In this talk, I'll describe how such differential forms on the free loop space provide a geometric refinement of Chern-Weil theory, as well as a geometric refinement of differential K-theory which contains holonomy information in its classes. This is joint work with Thomas Tradler and Mahmoud Zeinalian.