Titles and Abstracts
Workshop and Conference
on Topological Field Theories

May 18–29, 2009

Mohammed Abouzaid: "Chain level models for Fukaya categories "

Abstract: I will explain some situations in which the A-infinity structure coming from Lagrangian Floer theory are equivalent to classical DG structures from algebraic topology.

David Ayala: "Geometric cobordism categories"

Abstract: The talk will be about cobordism theory and its relationship to moduli spaces of geometric structures. I will begin by describing a cobordism category of d-manifolds which are endowed with a geometric structure. Examples of a geometric structure include that of a metric, a symplectic structure, a complex structure along with a holomorphic map, a gauge-theoretic connection, and others. The general notion of geometric structure will be phrased using the language of sheaves. The bulk of the talk will be devoted to identifying the homotopy type of such a category in terms of Thom spectra. This extends work of Galatius-Madsen-Tillmann-Weiss who study categories of manifolds with fiberwise structures on their tangent bundle. At the end I will focus on three particular applications which illustrate a more general phenomenon about (1) field theories, (2) stable moduli spaces, and (3) h-principles.

Julie Bergner: "Homotopy fiber products of homotopy theories in quantum algebra"

Alberto Cattaneo: "Chern-Simons theory revisited"

Ralph Cohen: "String topology, Hochschild homology, and Fukaya categories of the cotangent bundle"

Abstract: I will discuss an ongoing project with A. Blumberg and C. Teleman. We define and study the string topology A_∞ category of a closed, oriented manifold M. The objects are connected, closed, oriented submanifolds of M, and the morphisms between submanifolds N_1 and N_2 is a chain complex equivalent to the singular chains, $C_*(P(N_1, N_2))$, where $P(N_1, N_2)$ is the space of paths in M that begin in N_1 and end in N_2. The composition in this category is a chain model for the Sullivan open-string topology pairings in homology. We show that the Hochschild cohomology of this category is the homology of the free loop space, LM. This is predicted by Costello's work on topological conformal field theories. We then examine the case of a "single D-brane", N, and do corresponding Hochschild cohomology calculations of the endomorphism algebras, $C_*(P(N, N)$. I will end by describing implications to field theories given by the Hopkins- Lurie classification, as well as applications of these results to various Fukaya categories of the cotangent bundle, T^*M.

Kevin Costello: "Factorization algebras in perturbative quantum field theory"

Abstract: Factorization (or chiral) algebras were introduced by Beilinson and Drinfeld as a geometric formulation of the axioms of a vertex operator algebra. I will argue that the axioms of a factorization algebra encode a large part of the structure one expects from a quantum field theory, and state a theorem allowing one to construct a factorization algebras associated to perturbative quantum field theories. This is joint work with Owen Gwilliam.

Orit Davidovich: "Modular tensor categories over number fields" (Workshop talk)

Chris Douglas: ""2-dimensional algebra and quantum Chern-Simons field theory"

Gabriel Drummond-Cole: "Gravity and homotopy BV" (Worskshop talk)

Abstract: Vallette has described a resolution of the BV operad. Conjecturally, this gives rise to a minimal resolution in terms of a particular

homotopy operad. As a strict operad, this is isomorphic to the direct sum of the Gravity operad with $k[\delta]$. As a corollary of this and a simple fact about the higher homotopy structure, the Kontsevich-Manin-Barannikov passage from BV algebras satisfying the d-dbar lemma to Frobenius manifolds is generalized and put in perspective.

John Francis: "E_3-geometry and 3-dimensional TFTs" (Workshop talk)

Dan Freed: "Chern-Simons theory revisted"

Kenjii Fukaya: "K. Saito theory over a Novikov ring and its mirror"

Marco Gualtieri: "Groupoids and generalized complex branes"

Abstract: I will describe how symplectic groupoids shed light on the putative category of generalized complex branes such as the coisotropic A-branes of Kapustin and Orlov. I will also describe some new constructions of these groupoids which should be of particular interest.

Anton Kapustin: "Three-dimensional topological field theory with boundaries"

Abstract: The set of boundary conditions in a $3d$ Topological Field Theory has the structure of a 2-category. I describe this 2-category for the Rozansky-Witten model which is a 3d analog of the B-model. The 2-category of boundary conditions in this case can be viewed as a categorification of the derived category of coherent sheaves. I also outline how the Rozansky-Witten model is related to a categorification of deformation quantization.

Liang Kong: "Boundaries and domain walls in 2-d conformal field theories and topological orders"

Abstract: There are two themes of my talk. One is the so-called bulk-boundary (or open-closed) duality. The other is that certain group-like domain walls give dualities. These two are perhaps universal properties in many quantum field theories. In this talk, I will discuss them in 2-d conformal field theories and topological orders. I will start with boundary conformal field theories with a V-invariant boundary condition where V is a rational vertex operator algebra. A classification of such theories will be given at first. Then I will discuss the open-closed duality and domain walls in this framework. For topological orders, I will discuss those systems described by double

Chern-Simons theory with gapped boundaries and domain walls. Kitaev's toric code model will be given as an illustrating example. Then I will move on to Levin-Wen models for the general picture.

Jacob Lurie: "Topological Field Theories, Quantum Groups, and Geometric Langlands"

David Nadler "Langlands duality for character sheaves""

Abstract: I will explain how Lusztig's character sheaves fit into the framework of 3d TFT and S-duality. This is joint work with D. Ben-Zvi (Texas).

Nicolai Reshetikhin: "On semi-classical limits of quantum invariants"

Abstract: This talk will be a survey of semi-classical results for quantum invariants of links and 3-manifolds.

Charles Rezk: "Cartesian Presentations of weak n-categories"

Abstract: I'll describe a model for (infinity, n) categories, called "n-theta spaces"; this model is one way of generalizing the notion of a "complete Segal space", which is a model for (infinity, 1) categories. It is related to, but different than, the "n-fold complete Segal space" model invented by Barwick and used by Lurie. The category of "n-theta spaces" has two nice properties: it is enriched over spaces, and it is cartesian closed.

Lev Rozansky: "A 2-category of a holomorphic symplectic manifold"

Abstract: This is a sequel to A. Kapustin's talk describing our joint work on defining a 2-category for a holomorphic symplectic manifold X. The simplest objects of this 2-category are holomorphic Lagrangian submanifolds of X. A category of morphisms between two lagrangian submanifolds with clean intersection is, roughly speaking, an A-infinity deformation of the category of coherent sheaves on their intersection. I will give a detailed explanation of the 2-category for the case when X is a cotangent bundle of a complex manifold. Then the morphisms between two Lagrangian submanifolds form the category of matrix factorizations of the difference of their generating functions. I will also explain how a deformation of the holomorphic symplectic structure of the cotangent bundle translates into A_∞ deformations of the matrix factorization categories.

Dmitry Tamarkin: "Microlocal criterion for non-displaceability"

Abstract: Given two Lagrangian sumbanifolds in L_1 and L_2 in T^*X, I will give a criterion of their non-displaceability which does not use pseudo-holomorphic discs. Instead, using L_1 and L_2, one constructs homogenoeous co-isotropic submanifolds in $T^*(X \times \mathbb{R})$ and considers objects in the derived category of sheaves on $X \times \mathbb{R}$ with these submanifolds as their singular support. I will show that this method allows one to prove non-displaceability in some non-trivial cases. If time permits I will also discuss possible generalizations of this method to an arbitrary symplectic manifold (not just T^*X).

Christoph Wockel: "Higher connected covers by categorified principal bundles" (Workshop)