

ABSTRACTS HIGHER STRUCTURES CONFERENCE 2009

Speaker: Ozgur Ceyhan

Title: Open string theory and planar algebras

Abstract: In this talk, we show that abstract planar algebras are algebras over the topological operad of moduli spaces of stable maps with Lagrangian boundary conditions, which in the case of the projective line are described in terms of real rational functions. These moduli spaces appear naturally in the formulation of open string theory on the projective line. We also show two geometric ways to obtain planar algebras from real algebraic geometry, one based on string topology and one on Gromov-Witten theory. In particular, through the well known relation between planar algebras and subfactors, these results establish a connection between open string theory, real algebraic geometry, and subfactors of von Neumann algebras.

Speaker: Ralph Cohen

Title: String topology, Field Theories, and Fukaya categories

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 .

Speaker: Marius Crainic

Title: Representations up to homotopy

Abstract: I will report on joint work with C. Arias Abad and B. Dherin on the theory of representations up to homotopy of Lie groupoids and on the problem of constructing their tensor products.

Speaker: Vasily Dolgushev

Title: Proof of Swiss Cheese Conjecture

Abstract: For an associative algebra A we consider the pair "the Hochschild cochain complex $C^*(A, A)$ and the algebra A ". There is a natural 2-colored operad which acts on this pair. Using Batanin's recognition principle we show that this operad is quasi-isomorphic to the singular chain operad of Voronov's Swiss Cheese operad. This statement is the 2-dimensional case of the conjecture formulated by Maxim Kontsevich in 1999. This is based on a joint work with Dmitry Tamarkin and Boris Tsygan.

Speaker: Giovanni Felder

Title: D-branes and A-infinity bimodules in deformation quantization

Speaker: Gregory Ginot

Title: Higher dimensional analogs of Hochschild (co)homology

Speaker: Sergei Gukov

Title: Quantization via Fukaya category

Speaker: Owen Gwilliam

Title: Factorization algebras in perturbative quantum field theory

Abstract: In joint work with Kevin Costello, we try to capture the rich structure carried by the observables of a quantum field theory (e.g., correlation functions) using the notion of a factorization algebra. The talk will aim to motivate and unpack the definition before moving on to our main theorem, which is a kind of deformation quantization for field theory. The theorem states that the observables of a classical field theory form a commutative factorization algebra and that the Batalin-Vilkovisky procedure deforms this classical factorization algebra into the factorization algebra of observables for the associated quantum field theory. Time permitting, we may discuss examples or the relationship to TFTs (Lurie's topological chiral homology and Morrison-Walker's blob homology).

Speaker: Andrei Losev

Title: Higher instantonic theories and higher algebraic structures

Speaker: Ryszard Nest

Title: Formality for algebroid stacks

Abstract: We will give a sketch of the proof of the analogue of Kontsevich formality theorem for formal deformation of gerbes.

Speaker: Florian Schaetz

Title: Deformations of coisotropic submanifolds

Speaker: Pavol Severa

Title: Equivalence of formalities of the little disks operad

Abstract: There is a remarkable Drinfeld associator given by Kontsevich's integrals over configuration spaces of points in the plane. Kontsevich's and Tamarkin's formalities of the little disks operad are homotopic, if the latter uses this Drinfeld associator. The basic technical tool for this result is an L-infinity algebra of graphs and the fact that its cohomology is the Lie algebra of infinitesimal pure braids.

Speaker: Sergey Shadrin

Title: A cohomological field theory associated to a TCFT

Abstract: We'll discuss a construction that allows to associate an analog of Gromov-Witten potential to certain TCFTs. The soul of the construction is the brute-force homotopy extension of a TCFT to the Boardman-Vogt W -resolution of the Harvey compactification of the moduli spaces of curves.

It appears that the integral over the W -resolution of Harvey spaces splits in a natural way into the sum over Feynman diagrams that appear to be exactly an expansion of an element in the Givental group that one might apply in some more special cases in order to fix the boundary circle action for topological field theories on Harvey spaces.

This is an unfinished joint work with E. Getzler and A. Losev. A very similar construction also exists in an unfinished preprint of Katzarkov, Kontsevich, and Pantev.

Speaker: Mathieu Stienon

Title: Gerbes, principal 2-group bundles and characteristic classes

Abstract: It is well known that a principal G -bundle P over a manifold M determines a homotopy class of maps f from M to the classifying space BG of the group G . Pulling back the generators of $H^*(BG)$ through f , one obtains characteristic classes of the principal bundle P

over M . It is a classical theorem of Chern and many others that these characteristic classes coincide with those obtained from the Chern-Weil construction using connections and curvatures. Gerbes are higher order analogues of principal bundles. We will discuss an analogue of Chern's theorem for gerbes. The idea is to relate Gerbes to 2-group principal bundles, and to study characteristic classes of these principal 2-group bundles.

Speaker: Walter van Suijlekom

Title: Renormalization Hopf algebras for gauge theories and BRST-symmetries

Abstract: The structure of the Connes-Kreimer renormalization Hopf algebra is studied for Yang-Mills gauge theories, with particular emphasis on the BRST-formalism. A coaction of the renormalization Hopf algebra is defined on the coupling constants and the fields. In this context, BRST-invariance of the action implies the existence of certain Hopf ideals in the renormalization Hopf algebra, encoding the (physical) Slavnov-Taylor identities for the coupling constants.

Speaker: Dennis Sullivan

Title: The quantum lie bialgebra conjecture

Abstract: String topology operations can be parametrised by a time-like compactifications of Riemann's moduli spaces. The top dimensional chains provide a solution of a master equation in the algebraic topology of the free loop space of any manifold. This compactification for string topology will appear in the 2010 CUNY thesis of Kate Poirier. Such a chain level solution to this master equation compresses up to homotopy to an element of square zero in the graded weyl algebra of the reduced equivariant homology of the free loop space. Such a nilpotent element is the same as an action of the cobar of the cofrobenius coproperad. (2010 CUNY thesis of Gabriel Drummond-Cole and joint work of the latter with Terilla and Tradler)

Such structures have been determined as well using J-holomorphic curves for a pair consisting of a contact manifold and a symplectic filling. There is a working conjecture (Eliashberg, Cieliebak-Latschev) that by replacing the arbitrary target manifold of string topology by the (symplectic, contact) pair consisting of its cotangent (disk, sphere) bundle in the J-holomorphic curves context these two similar structures would be equivalent. If so, a rather deep invariant from PDE expressed in terms of higher structures can hopefully be calculated by classical algebraic topology."

Speaker: Bruno Vallette

Title: Homotopy theory of homotopy algebras

Abstract: We will develop the homotopy theory for a wide class of algebraic structure: the transfer through homotopy equivalences, the minimal-contractible decomposition and the inversion of homotopy quasi-isomorphisms will be proved in full generality. This theory will be applied to extend Kontsevich formality theorem to the homotopy Batalin-Vilkovisky framework, answering a conjecture of Tamarkin-Tsygan. [Joint work with Damien Calaque]

Speaker: Alan Weinstein

Title: Symplectic categories

Abstract: Quantization problems suggest that the category of symplectic manifolds and symplectomorphisms should be augmented by the inclusion of more general morphisms, namely canonical relations, i.e. lagrangian submanifolds of products. It is well known that these relations compose well when a transversality condition is satisfied, but the failure of this condition to hold in general means that they do not comprise the morphisms of a category.

In these lectures, I will discuss several existing and potential remedies to the transversality problem. Some of these involve restriction to classes of lagrangian submanifolds for which the transversality property automatically holds. Others involve allowing lagrangian "objects" more general than submanifolds.

Speaker: Chenchang Zhu

Title: Semidirect products of representations up to homotopy

Abstract: We display many examples of semidirect products of representations up to homotopy. They are related to Courant algebroids, omni Lie algebras, and string Lie 2-algebras. Then we discuss a procedure to integrate these semidirect products by integrating certain L-infinity morphisms..