

Schedule

Events for:
Monday, May 20th - Friday, May 24th

Monday, May 20th

10:00am **Kai Cieliebak (I) - SCGP 102**

Speaker: Kai Cieliebak

Title: Symplectic field theory, string topology, and perturbative Chern-Simons theory

Abstract: Symplectic field theory is an algebraic framework encoding codimension one degenerations of moduli spaces of holomorphic curves in symplectic cobordisms. String topology is an algebraic framework encoding transverse intersections of chains in the loop space of a manifold. Perturbative Chern-Simons theory refers to integrals over configuration spaces arising in the perturbative expansion of the Chern-Simons partition function on a three-manifold. It turns out that these three theories are closely related, and this relationship provides new insights in each of them: it yields some explicit computations in symplectic field theory, reveals new dualities in string topology, and leads to a generalization of perturbative Chern-Simons to manifolds of arbitrary dimension.

11:00am **Coffee break - SCGP Cafe**

11:30am **Ivo Sacks - SCGP 102**

Speaker: Ivo Sacks

Title: Applications of Homotopy Algebras to (Super) String Field Theory

Abstract: Homotopy algebra and its involutive generalisation plays an important role in the construction of (super) string field theory. I will review recent progress in these applications of homotopy algebra, their operadic description and its relation to (super) moduli spaces.

12:30pm **Lunch - SCGP Cafe**

2:00pm **Gong Show: Peter Teichner - scgp 102**

Speaker: Peter Teichner 4-manifolds and topological modular forms This is a short report on a recent paper of Gukov-Pei-Putrov-Vafa. They use physically predicted 6-dim. susy CFTs to get smooth 4-manifold invariants with values in topological modular forms. Their work is motivated by a conjecture of Stephan Stolz and myself, namely that the space of topological modular forms can be constructed from a space of 2|1-dim. susy EFTs. I'll try to say a few words why we believe this to be true

2:10pm **Gong Show: Claudia Scheimbauer - SCGP 102**

Speaker: Claudia Scheimbauer

Title: A glimpse on (topological) relative/twisted field theories

Abstract: I will outline an approach using relative dualizability to construct relative topological field theories and mention a first example.

2:30pm **Gong Show: Eugene Rabinovich - SCGP102**

Speaker: Eugene Rabinovich

Title: Factorization algebras on manifolds with boundary"

Abstract: We describe the elements of an approach, joint with Ben Albert, to the construction of factorization algebras of observables for a certain class of quantum field theories on manifolds with boundary. The class we consider are field theories which are topological normal to the boundary. As a main application of these methods, we expect to be able to construct quantizations of Poisson-algebraic objects, such as the algebra of functions on a formal Poisson manifold and its holomorphic analogue.

2:40pm **Break - SCGP102**

2:50pm **Gong Show: Corbett Redden - scgp102**

Speaker: Corbett Redden

Title: Equivariant gerbe connections

Abstract: Gerbes are a useful 2-categorical generalization of principal bundles. When a Lie group acts on the base manifold, I will define equivariant gerbe connections. I will then state theorems that justify why this is a "correct definition.

3:00pm **Gong Show: Kyler Siegel - scgp102**

Speaker: Kyler Siegel

Title: Symplectic capacities from filtered BV-infinity algebras"

Abstract: I will explain a general formalism which associates to any compact symplectic manifold with boundary a filtered BV-infinity algebra, and then extracts from this data a large family of real-valued symplectic invariants. These numerical invariants gives obstructions to symplectic embeddings which are new even for simple problems like embedding one polydisk into another.

3:10pm **Gong Show: Bertram Arnold - scgp102**

Speaker: Bertram Arnold

Title: Supersymmetric Field Theories from Superconnections

Abstract: The parallel transport of a connection ∇ on a finite-dimensional vector bundle gives rise to a topological field theory parametrized by its base. If ∇ is flat, it also defines a functor from the fundamental 1-groupoid of the base to vector spaces. This was extended by Igusa: A flat superconnection on a vector bundle gives rise to a functor from the fundamental ∞ -groupoid of the base to chain complexes. I will explain how to construct from any superconnection a supersymmetric euclidean field theory parametrized by the base which recovers this construction if the superconnection is flat.

3:20pm **Gong Show: Richard Eager - scgp102**

Speaker: Richard Eager

Title: Holomorphic field theories and pure spinors

Abstract: I will discuss holomorphic twists of supersymmetric field theories, such as 10-dimensional SYM, and connections with pure spinors.

3:30pm **Coffee break - SCGP Cafe**

4:00pm **Olivia Dumitrescu - SCGP 102**

Speaker: Olivia Dumitrescu

Title: Interplay between ribbon graphs and CohFT

Abstract: We will review an axiomatic formulation of a 2D TQFT whose formalism is based on the edge-contraction operations on graphs drawn on a Riemann surface (cellular graphs). We will describe a new result, that ribbon graphs provide both cohomological field theory and a visual explanation of Frobenius-Hopf duality. This is based on work in progress with Motohico Mulase.

Tuesday, May 21st

9:30am **Kai Cieliebak (II) - SCGP 102**

Speaker: Kai Cieliebak

Title: Symplectic field theory, string topology, and perturbative Chern-Simons theory

Abstract: Symplectic field theory is an algebraic framework encoding codimension one degenerations of moduli spaces of holomorphic curves in symplectic cobordisms. String topology is an algebraic framework encoding transverse intersections of chains in the loop space of a manifold. Perturbative Chern-Simons theory refers to integrals over configuration spaces arising in the perturbative expansion of the Chern-Simons partition function on a three-manifold. It turns out that these three theories are closely related, and this relationship provides new insights in each of them: it yields some explicit computations in symplectic field theory, reveals new dualities in string topology, and leads to a generalization of perturbative Chern-Simons to manifolds of arbitrary dimension.

10:30am **Coffee break - SCGP Cafe**

10:45am **Roberta Iseppi - SCGP 102**

Speaker: Roberta Iseppi

Title: Noncommutative manifolds and the BV construction: the case of $\mathfrak{su}(n)$ -matrix models

Abstract: The talk will describe the BV construction from the point of view of noncommutative geometry: given a class of $\mathfrak{su}(n)$ -gauge theories, which are naturally induced by finite spectral triples, we will describe how the corresponding BV-extended theory could be encoded in a 0-dim. noncommutative manifold. In particular, by introducing the notion of BV-spectral triple, we are able to give a (noncommutative) geometric interpretation to all the elements that characterize the BV-extended theory, such as bosons and fermions or fields and anti fields, and to the different role they play.

11:45am **Lunch - SCGP Cafe**

1:00pm **SCGP Weekly talk: Owen Gwilliam**

Speaker: Owen Gwilliam

Title: Weaving higher algebra through strings and fields

Abstract: We will overview some ways that ideas from higher algebra (such as operads and categories) appear in field theory and string theory, emphasizing themes of this week's workshop.

2:15pm **Gong Show: Brano Jurco - scgp102**

Speaker: Brano Jurco

Title: Quantum L_∞ Algebras and the Homological Perturbation Lemma
Abstract: Quantum L_∞ algebras are a generalization of L_∞ algebras with a scalar product and with operations corresponding to higher genus graphs. We construct a minimal model of a given quantum L_∞ algebra via the homological perturbation lemma and show that it is given by a Feynman diagram expansion, computing the effective action in the finite-dimensional Batalin-Vilkovisky formalism. We also construct a homotopy between the original and this effective quantum L_∞ algebra. Finally, we briefly comment on the odd symplectic category of quantum L_∞ algebras.

2:25pm **Gong Show: Laura Wells - scgp102**

Speaker: Laura Wells

Title: Equivariant factorization algebras

Abstract: Factorization algebras are a mathematical tool used to encode the data of the observables of a field theory. I will describe a result comparing two different notions of factorization algebras: equivariant factorization algebras over the opens of a fixed manifold, and factorization algebras over a site of manifolds equipped with a certain geometric structure; namely that the $(\infty,1)$ -categories of these respective factorization algebras are equivalent. I will briefly discuss work in progress about generalizing this result to the case of smooth families of factorization algebras.

2:35pm **Gong Show: Pavel Hajak - scgp102**

Speaker: Pavel Hajak

Title: Computations of the twisted IBL-infinity structure

Abstract: The homotopy type of the twisted IBL-infinity structure on cyclic cochains of de Rham cohomology of a simply-connected manifold is determined by the tree-level perturbative Chern-Simons theory for a special Hodge propagator. The 1-loop diagrams appear in the non-simply-connected case and the n-

2:45pm **Break - scgp102**

2:55pm **Gong Show: Mahmoud Zeinalian - scgp102**

Speaker: Mahmoud Zeinalian

Title: The Hodge and de Rham Chern Characters of holomorphic connections (w/ Chyene Miller, Micah Miller, and Thomas Tradler)

Abstract: We address a question concerning the existence of formulae for the Hodge and de Rham characteristic classes of bundles solely in terms of their clutching functions. Naturally, such formulae would apply readily not just to manifolds but to group actions and more. We define a map of simplicial presheaves, the Chern character, that assigns to every sequence of composable non-connection-preserving isomorphisms of vector bundles with holomorphic connections an appropriate sequence of holomorphic forms. Applying this to the nerve of a cover and taking homotopy limit gives rise to the desired answer.

3:05pm **Gong Show: Gregory Ginot - scgp102**

Speaker: Gregory Ginot

Title: A factorization algebra perspective on the Loday-Quillen Tsygan theorem

Abstract: The Loday-Quillen Tsygan theorem computes (co)homology of Lie algebras of matrices over A in terms of cyclic (co)homology of A . We will explain how to lift this result to a comparison of factorization algebras exhibiting it LQT as a $n=0$ case of a family of computations expliciting the centralizer of E_n -enveloping algebras of matrices.

3:15pm **Gong Show: Brian Williams - scgp102**

Speaker: Brian Williams

Title: A 5d/4d correspondence via higher Kac-Moody algebras

Abstract: There is an analog of the affine Kac-Moody algebra which describes symmetries of holomorphic field theories in arbitrary complex dimension, in analogy with ordinary CFT on Riemann surfaces. I will describe a compelling appearance of these algebras in a correspondence between a 5-dimensional gauge theory and a holomorphic theory living at the boundary.

3:25pm **Gong Show: Yehao Zhou - scgp102**

Speaker: Yehao Zhou

Title: The existence and uniqueness of (super) string vertices.

Abstract: String vertices are key ingredients in string field theory. In this talk, I will define (super) string vertices and state the existence and uniqueness of them. If time permits, I can say something about the proof.

3:45pm **Coffee break - SCGP Cafe**

4:15pm **Pavel Mnev - SCGP 102**

Speaker: Pavel Mnev

Title: Two-dimensional BF theory as a conformal field theory

Abstract: We study topological BF theory on the complex plane in Lorenz gauge. In abelian case, we find that the gauge-fixed theory is a B-twisted $N=(2,2)$ superconformal theory - Witten's B-model with a parity-reversed target. In the non-abelian case, the theory becomes a logarithmic CFT with correlators given by convergent integrals (e.g. 4-point functions are expressed via dilogarithms). We find vertex operators in the non-abelian theory, receiving a quantum correction to conformal dimension. This is a report on a joint work with Andrey Losev and Donald Youmans arXiv:1712.01186, arXiv:1902.02738.

Wednesday, May 22nd

10:00am **Kai Cieliebak (III) - SCGP 102**

Speaker: Kai Cieliebak

Title: Symplectic field theory, string topology, and perturbative Chern-Simons theory

Abstract: Symplectic field theory is an algebraic framework encoding codimension one degenerations of moduli spaces of holomorphic curves in symplectic cobordisms. String topology is an algebraic framework encoding transverse intersections of chains in the loop space of a manifold. Perturbative Chern-Simons theory refers to integrals over configuration spaces arising in the perturbative expansion of the Chern-Simons partition function on a three-manifold. It turns out that these three theories are closely related, and this relationship provides new insights in each of them: it yields some explicit computations in symplectic field theory, reveals new dualities in string topology, and leads to a generalization of perturbative Chern-Simons to manifolds of arbitrary dimension.

11:00am **Coffee break - SCGP Cafe**

11:30am **Gaetan Borot - SCGP 102**

Speaker: Gaetan Borot

Title: Geometric recursion and recursion for volumes of moduli spaces

Abstract: I will present the formalism of geometric recursion (GR), developed with Andersen and Orantin. Let \mathcal{B} be the category of bordered surfaces with morphisms given by isotopy classes of diffeomorphisms. Given a functor from \mathcal{B} to another category \mathcal{V} together with some extra data, the goal of GR is to construct functorial assignments valued in \mathcal{E} (which can roughly be thought as a twisted field theory), exploiting the idea of glueing. This will be illustrated with $\mathcal{E}(S) = \text{Functions on } \text{Teich}(S)$, and the GR functions are designed such that their integration over the moduli space against the Weil-Petersson volume form satisfy a topological recursion. I will give a few examples of applications. This is based on joint works with Andersen, Orantin, Charbonnier, Delecroix, Giacchetto, Lewanski and Wheeler.

12:30pm **Lunch - SCGP Cafe**

2:30pm **Andrei Caldararu - SCGP 102**

Speaker: Andrei Caldararu

Title: Categorical Gromov-Witten invariants: a computable definition

Abstract: In his 2005 paper "The Gromov-Witten potential associated to a TCFT" Kevin Costello described a procedure for recovering an analogue of the Gromov-Witten potential directly out of a Calabi-Yau category. The main difficulty to be overcome in that paper was dealing with the fact that TCFT's constructed from Calabi-Yau categories are always required to have at least one input. This problem was originally solved in a non-constructive fashion using dg-Weyl algebras and associated Fock spaces. In my talk I shall describe recent joint work on giving a new definition of Costello's invariants. We bypass the dg-Weyl algebra approach completely. Instead we use a Koszul resolution of the space of Sigma_n-invariant chains on $M_{\{g,n\}}$. This approach involves no choices, and makes the new invariants amenable to explicit computer calculations. I will list some of the higher genus invariants that we computed; they agree with predictions from mirror symmetry. This talk is based on joint works with Junwu Tu and with Kevin Costello.

3:30pm **Coffee break - SCGP Cafe**

4:00pm **Kevin Costello (I) - SCGP 102**

Speaker: Kevin Costello

Title: The Green-Schwarz mechanism and higher-loop anomaly cancellation in topological string field theory

Abstract: The Green-Schwarz mechanism explains how one-loop anomalies are cancelled in physical string field theory. I will explain a version of this mechanism that applies to the open-closed string field theory associated to the topological B-model. Remarkably, in this context, the one-loop anomaly cancellation extends to all orders in the loop expansion, fixing the quantum theory uniquely. Along the way, I will introduce a Type I version of the topological string, for any Calabi-Yau manifold of odd dimension. For this Type I topological string field theory, anomaly cancellation holds only for particular open string gauge groups. In complex dimension 5, the group must be SO(32), and in dimension 3, the group must be SO(8).

Thursday, May 23rd

10:00am **Kevin Costello (II) - SCGP 102**

Speaker: Kevin Costello

Title: The Green-Schwarz mechanism and higher-loop anomaly cancellation in topological string field theory

Abstract: The Green-Schwarz mechanism explains how one-loop anomalies are cancelled in physical string field theory. I will explain a version of this mechanism that applies to the open-closed string field theory associated to the topological B-model. Remarkably, in this context, the one-loop anomaly cancellation extends to all orders in the loop expansion, fixing the quantum theory uniquely. Along the way, I will introduce a Type I version of the topological string, for any Calabi-Yau manifold of odd dimension. For this Type I topological string field theory, anomaly cancellation holds only for particular open string gauge groups. In complex dimension 5, the group must be $SO(32)$, and in dimension 3, the group must be $SO(8)$.

11:30am **Barton Zwiebach - SCGP 102**

Speaker: Barton Zwiebach

Title: Quantum L_∞ algebras and their realization in closed string field theory

Abstract: I will review and discuss the algebraic structure underlying Quantum Closed String Field Theory and will report on progress using Riemann surfaces to achieving a concrete construction of all products in this algebra.

11:45am **Coffee break - SCGP Cafe**

12:30pm **Lunch - SCGP Cafe**

2:30pm **Bruno Vallette - SCGP 102**

Speaker: Bruno Vallette

Title: The ubiquity of operadic calculus

Abstract: There are basically two ways to do higher algebra: with model or higher categories or with operadic calculus. In the latter case, unlike in the former case, one gets explicit formulas which allow one to study questions like formality properties for instance. Operadic calculus provide us with seminal tools like the bar-cobar constructions, infinity-morphisms and the homotopy transfer theorem that lie at the core of special sequences, cyclic homology, rational homotopy theory and the Batalin--Vilkovisky formalism for instance. In this talk, I will try to review the present state of the art in this domain and to present some striking new results in universal algebra (Dotsenko—Tamaroff), rational homotopy theory (Campos—Petersen—Robert-Nicoud—Wierstra), gauge theory (Dotsenko—Shadrin—Vallette). For instance, I will explain how the operadic calculus can be extended from operads to properads (Hoffbeck—Leray—Vallette) in order to treat the homotopy properties of bialgebras, like involutive Lie bialgebras (Cieliebak—Fukaya—Latschev).

3:30pm **Coffee break - SCGP Cafe**

4:00pm **Chris Schommer-Pries - SCGP 102**

Speaker: Chris Schommer-Pries

Title: The Tangle Hypothesis

Abstract: I will discuss the cobordism hypothesis, the closely related tangle hypothesis, and recent work towards them.

Friday, May 24th

10:00am **Kasia Rejzner - SCGP 102**

Speaker: Kasia Rejzner

Title: BV formalism in causal quantum field theory

Abstract: I will explain how BV formalism is used to build models of causal quantum field theories. The main application is to construct QFTs on globally hyperbolic spacetimes, but the same formalism can be used in a more general setting, provided one has the appropriate notion of 'causal structure' available. I will present a few examples and remark on the connection to factorization algebras.

11:00am **Coffee break - SCGP Cafe**

11:30am **Kevin Costello (III) - SCGP 102**

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Title: The Green-Schwarz mechanism and higher-loop anomaly cancellation in topological string field theory

Abstract: The Green-Schwarz mechanism explains how one-loop anomalies are cancelled in physical string field theory. I will explain a version of this mechanism that applies to the open-closed string field theory associated to the topological B-model. Remarkably, in this context, the one-loop anomaly cancellation extends to all orders in the loop expansion, fixing the quantum theory uniquely. Along the way, I will introduce a Type I version of the topological string, for any Calabi-Yau manifold of odd dimension. For this Type I topological string field theory, anomaly cancellation holds only for particular open string gauge groups. In complex dimension 5, the group must be $SO(32)$, and in dimension 3, the group must be $SO(8)$.

12:30pm **Lunch - SCGP Cafe**