Categorical Symmetries in Quantum Field Theory (Conference and School)

Report of Contributions

Contribution ID: **1**   Type: **not specified**

Christoph Schweigert: String-net methods for CFT correlators

Monday, 28 August 2023 09:00 (1 hour)

Based on a graphical calculus for pivotal bicategories, we develop a string-net construction of a modular functor. We show that a rigid separable Frobenius functor between strictly pivotal bicategories induces a linear map between the corresponding bicategorical string-net spaces that is compatible with the mapping class group actions and with sewing. This result implies that correlators of two-dimensional conformal field theories factorize over string-net spaces constructed from defect data.

Contribution ID: **2**   Type: **not specified**

Anton Kapustin: Symmetries, anomalies, and the bulk-boundary correspondence

Monday, 28 August 2023 10:15 (1 hour)

't Hooft anomalies are obstructions to gauging a global symmetry of a QFT. In one spatial dimension 't Hooft anomaly of a Lie group symmetry can also be described purely algebraically, without a reference to gauging: it manifests itseld a non-trivial central extension of the current algebra. In higher dimensions, there is no completely satisfactory algebraic reformulation of 't Hooft anomaly. In this talk, I will argue that such an algebraic reformulation should involve higher-form symmetries. To support this claim I will discuss analogous issues for gapped lattice systems in one dimension higher which are related to QFT via the bulk-boundary correspondence.

Contribution ID: **3**   Type: **not specified**

Mayuko Yamashita: Topological modular forms and heretoric string theory

Monday, 28 August 2023 11:15 (1 hour)

In this talk I will explain my works with Y. Tachikawa to study anomaly in heterotic string theory via homotopy theory, especially the theory of Topological Modular Forms (TMF). TMF is an E-infinity ring spectrum which is conjectured by Stolz-Teichner to classify two-dimensional supersymmetric quantum field theories in physics. In the previous work (https://arxiv.org/abs/2108.13542), we proved the vanishing of anomalies in heterotic string theory mathematically by using TMF. Furthermore, we have a recent update (https://arxiv.org/abs/2305.06196) on the previous work. Because of the vanishing result, we can consider a secondary transformation of spectra, which is shown to coincide with the Anderson self-duality morphism of TMF. This allows us to detect subtle torsion phenomena in TMF by differential-geometric ways.

Contribution ID: **4**   Type: **not specified**

Simons Dialogue

Monday, 28 August 2023 16:45 (1 hour)

Contribution ID: **5**   Type: **not specified**

David Ayala: Derived Skein modules via factorization homology

Friday, 1 September 2023 10:15 (1 hour)

In this talk, I will motivate derived Skein modules, which recover (classical) Skein modules while possessing a host of expected continuous symmetries, functorialities, and local-to-global formulae. Then, using factorization homology, I will outline how to construct derived Skein modules.

Contribution ID: **6**   Type: **not specified**

Mathew Bullimore: Representation theory for categorical symmetries

Tuesday, 29 August 2023 10:15 (1 hour)

My talk is about how categorical symmetries act on and organise the spectrum of non-topological extended operators in QFT. I will address this question from two equivalent perspectives: the representation theory of higher tube algebras and the sandwich construction of symmetries via the Drinfeld center. I'll discuss a variety of examples in three dimensions: invertible symmetries and higher twisted Drinfeld doubles, Ising-like symmetries, and braided fusion symmetries. Based on https://arxiv.org/abs/2305.17165.

Contribution ID: **7** Type: **not specified**

Chelsea Walton: Reflective centers of module categories and quantum K-matrices

Tuesday, 29 August 2023 11:15 (1 hour)

This talk will be on recent joint work with Robert Laugwitz and Milen Yakimov (arXiv:2307.14764) that is motivated by obtaining solutions to the quantum reflection equation (qRE). To start, given a braided monoidal category C and C-module category M, we introduce a version of the Drinfeld center Z(C) of C adapted for M. We refer to this category as the "reflective center" E_C(M) of M. Just like Z(C) is a canonical braided monoidal category attached to C, we show that E_C(M) is a canonical braided module category attached to M. When C is the category of modules over a quasitriangular Hopf algebra H, and M is the category of modules over an H-comodule algebra A, we show that E_C(M) is equivalent to a category of modules over an explicit algebra, which we call the "reflective algebra" R_H(A) of A. Here, R_H(A) is akin to Drinfeld double of H. We show that reflective algebras are quasitriangular H-comodule algebras, and examine their corresponding quantum K-matrices (which are solutions to the qRE).

Contribution ID: **8**   Type: **not specified**

Gong Show

Tuesday, 29 August 2023 17:45 (1 hour)

Contribution ID: **9**　　　　　　　　　　　Type: **not specified**

Gong Show

Wednesday, 30 August 2023 09:00 (1 hour)

Contribution ID: **10**   Type: **not specified**

Catherine Meusburger: Turaev-Viro-Barrett-Westbury state sums with defects

Wednesday, 30 August 2023 10:15 (1 hour)

We define a Turaev-Viro-Barrett-Westbury state sum model of triangulated 3-manifolds with surface defects (oriented 2d surfaces), line defects and point defects (graphs on the defect surfaces). Surface defects are labeled with bimodule categories over spherical fusion categories with bimodule traces, line and point defects with bimodule functors and
bimodule natural transformations. The state sum uses generalised 6j symbols that encode the coherence isomorphisms of the defect data. We prove the triangulation independence of the state sum and show that it can be computed with polygon diagrams that satisfy the cutting and gluing identities for polygon presentations of oriented surfaces. State
sums detect the genus of a defect surface and are sensitive to its embedding. Defect lines on defect surfaces with trivial defect data define ribbon invariants for the centre of the underlying spherical fusion category. Reference: C. Meusburger, State sum models with defects based on spherical fusion categories, Adv. Math. 429 (2023), DOI:10.1016/j.aim.2023.109177

Contribution ID: **11** Type: **not specified**

Sakura Schafer-Nameki: Categorical Symmetries and Generalized Charges

Wednesday, 30 August 2023 11:15 (1 hour)

I will give a summary of recent works on global categorical symmetries in QFTs, with a focus on non-invertible symmetries and their description in terms of fusion higher categories. In addition to discussing the symmetries, I will also introduce the notion of a generalized charge, and provide several examples of this for both invertible and non-invertible symmetries.

Contribution ID: **12** Type: **not specified**

Owen Gwilliam: Symmetries via factorization algebras

Thursday, 31 August 2023 09:00 (1 hour)

Factorization algebras arose in topology and representation theory but also provide a framework for describing the observables and symmetries of a field theory. This talk will begin by surveying factorization algebras and what they do well – and do not – in physics, at least at present. In the latter part we will describe work in progress with Araminta Amabel on selection rules for line operators of gauge theories, transposing Dan Freed's argument into the key of factorization algebras.

Contribution ID: **13**   Type: **not specified**

Maissam Barkeshli: TBA

Tuesday, 29 August 2023 09:00 (1 hour)

Contribution ID: 14   Type: **not specified**

Kevin Walker: Categorified idempotent completion, topological symmetries of QFTs, and generalized Kramers-Wannier duality

Thursday, 31 August 2023 11:15 (1 hour)

Any (n-pivotal) n-category C can be embedded in a Morita-equivalent completion Cˆ#. Because of the Morita equivalence, any module/action of C automatically leads to one of the larger category Cˆ#. In particular, discrete k-form symmetries of d-dimensional QFTs correspond to actions of $C(G, d+1, k+1) = \pi_{\le d+1}(B^{k+1}(G))$, and therefore give rise to actions of the completed (d+1)-category $C(G, d+1, k+1)\hat{}\#$. While $C(G, d+1, k+1)$ is built out of invertible morphisms, $C(G, d+1, k+1)\hat{}\#$ typically contains many non-invertible morphisms leading to non-invertible symmetries of the original QFT. I'll also discuss how completed n-categories can be used to construct many new examples of Kramers-Wannier-type dualities. This is joint work with Fiona Burnell.

Contribution ID: **15**   Type: **not specified**

Zohar Komargodski: Applications of Symmetries for Conformal Defects

Thursday, 31 August 2023 17:45 (1 hour)

Contribution ID: **16** Type: **not specified**

Kantaro Ohmori: Non-supersymmetric heterotic branes, bordisms, 2d SCFTs

Friday, 1 September 2023 09:00 (1 hour)

The no-bordism conjecture by McNamara and Vafa states that the bordism group with tangential structure and branes (singularity types) for a consistent quantum gravity should vanish.
This predicted previously unknown non-supersymmetric branes in string theory which should cancel the apparently nontrivial bordism classes.
In this talk I will propose the worldsheet theories of a string in the throat region of some of the predicted new branes in heterotic string theory.
I will also describe the relation to Stolz-Teichner conjecture as a connection to Yamashita's talk.

The no-bordism conjecture by McNamara and Vafa states that the bordism group with tangential structure and branes (singularity types), for consistent quantum gravity, should vanish. As a corollary of the conjecture they predicted previously unknown non-supersymmetric branes in string theory, which are required to cancel the apparently nontrivial bordism classes. In this presentation, I will propose the worldsheet theories of a string in the throat region of some of the predicted branes in heterotic string theory.
Additionally, I will mention the relationship to the Stolz-Teichner conjecture and connect it to Yamashita's talk.

Contribution ID: 17   Type: **not specified**

Kenneth Intriligator: Anomalies of 4d Spin_G theories

Thursday, 31 August 2023 10:15 (1 hour)

We consider 't Hooft anomalies for a variety of 4d gauge theories whose fermion matter content admits Spin_G(4) generalized spin structure, with G gauged or global.
We discuss and compute the w2 w3 type 't Hooft anomalies that arise in this context, and aspects of anomaly matching in the possible IR phases. Based on work with T. Daniel Brennan.

Contribution ID: **18**   Type: **not specified**

Shu-Heng Shao: Non-invertible Symmetries

Monday, 4 September 2023 09:00 (1 hour)

Contribution ID: **19**　　　　　　　　　　　　　　　　　　Type: **not specified**

Shu-Heng Shao: Non-invertible Symmetries

Monday, 4 September 2023 10:15 (1 hour)

Contribution ID: **20** Type: **not specified**

David Jordan: Applied Cobordism Hypothesis

Monday, 4 September 2023 11:15 (1 hour)

Contribution ID: **21** Type: **not specified**

David Jordan: Applied Cobordism Hypothesis

Monday, 4 September 2023 15:30 (1 hour)

Contribution ID: **22**   Type: **not specified**

Discussion

Monday, 4 September 2023 17:00 (1 hour)

Contribution ID: **23** Type: **not specified**

Shu-Heng Shao: Non-invertible Symmetries

Tuesday, 5 September 2023 09:00 (1 hour)

Contribution ID: 24　　　　　　　　　　　　　　　　　Type: **not specified**

Shu-Heng Shao: Non-invertible Symmetries

Tuesday, 5 September 2023 10:15 (1 hour)

Contribution ID: **25**   Type: **not specified**

Constantin Teleman: The Mathematics of TQFTs and Defects

Tuesday, 5 September 2023 11:15 (1 hour)

Contribution ID: **26**   Type: **not specified**

Constantin Teleman: The Mathematics of TQFTs and Defects

Tuesday, 5 September 2023 15:30 (1 hour)

Contribution ID: **27**   Type: **not specified**

Shu-Heng Shao: Non-invertible Symmetries

Tuesday, 5 September 2023 17:00 (1 hour)

Contribution ID: **28** Type: **not specified**

Discussion

Tuesday, 5 September 2023 18:00 (1 hour)

Contribution ID: **29** Type: **not specified**

Gong Show

Tuesday, 5 September 2023 20:00 (2 hours)

Contribution ID: **30**   Type: **not specified**

Michele Del Zotto: Symmetry Categories 101

Wednesday, 6 September 2023 09:00 (1 hour)

Contribution ID: **31** Type: **not specified**

Michele Del Zotto: Symmetry Categories 101

Wednesday, 6 September 2023 10:15 (1 hour)

Contribution ID: **32**   Type: **not specified**

David Jordan: Applied Cobordism Hypothesis

Wednesday, 6 September 2023 11:15 (1 hour)

Contribution ID: **33**   Type: **not specified**

David Jordan: Applied Cobordism Hypothesis

Wednesday, 6 September 2023 17:00 (1 hour)

Contribution ID: **34**   Type: **not specified**

Constantin Teleman: The Mathematics of TQFTs and Defects

Contribution ID: **35** Type: **not specified**

Constantin Teleman: The Mathematics of TQFTs and Defects

Thursday, 7 September 2023 11:15 (1 hour)

Contribution ID: **36** Type: **not specified**

Michele Del Zotto: Symmetry Categories 101

Contribution ID: 37   Type: **not specified**

Michele Del Zotto: Symmetry Categories 101

Contribution ID: **38** Type: **not specified**

Discussion

Thursday, 7 September 2023 18:00 (1 hour)

Contribution ID: **39**   Type: **not specified**

Constantin Teleman: The Mathematics of TQFTs and Defects

Friday, 8 September 2023 10:15 (1 hour)

Contribution ID: **40** Type: **not specified**

David Jordan: Applied Cobordism Hypothesis

Friday, 8 September 2023 09:00 (1 hour)

Contribution ID: 41   Type: **not specified**

Michele Del Zotto: Symmetry Categories 101

Friday, 8 September 2023 11:15 (1 hour)

Contribution ID: **42**

Type: **not specified**

Michele Del Zotto: Symmetry Categories 101

Thursday, 7 September 2023 09:00 (1 hour)

Contribution ID: **43**   Type: **not specified**

Michele Del Zotto: Symmetry Categories 101

Thursday, 7 September 2023 10:15 (1 hour)

Contribution ID: 44   Type: **not specified**

Discussion

Wednesday, 6 September 2023 18:00 (1 hour)

Contribution ID: 45 Type: **not specified**

Constantin Teleman: The Mathematics of TQFTs and Defects

Thursday, 7 September 2023 17:00 (1 hour)