Physics from the Point of View of Geometry
29-30 September 2022
L1

Abstracts of Talks

David Ben-Zvi (University of Texas, Austin)

Title: Higher geometric quantization and L-functions

Abstract: I'll describe a perspective on the theory of L-functions inspired by geometric quantization, developed in joint work with Yiannis Sakellaridis and Akshay Venkatesh. To a suitable class of hamiltonian actions of reductive groups one attaches two ``higher" quantization problems [in the sense of higher-dimensional QFT], one dubbed magnetic or automorphic and the other electric or spectral. Electric-magnetic / Langlands duality exchanges these quantization problems for dual reductive groups. I'll explain how, when considered in arithmetic contexts, the notion of automorphic quantization captures the theory of periods of automorphic forms, while spectral quantization captures the theory of L-functions of Galois representations.

Dan Freed

Title: A time-reversal anomaly, bordism, and index theory

Abstract: I'll describe joint work with Mike Hopkins in which we prove an anomaly cancellation theorem in M-theory, an 11-dimensional flavor of string theory. I assume no physics, so begin with a general discussion of anomalies and slowly close in on the problem at hand. The techniques used to solve the problem involve bordism computations, index theory, and the theory of cubic forms.

Søren Galatius (University of Copenhagen)

Title: Equivariant bordism categories and their classifying spaces

Abstract: To a small topological category C can be associated its classifying space BC, which retains some information about C but not everything (except when C is a groupoid, in which case C is equivalent to the fundamental groupoid of BC). When C is the cobordism category whose objects are the closed smooth (d-1)-manifolds and whose morphisms are the compact d-dimensional cobordisms, it turned out that BC has an interesting and explicitly describable homotopy type. I will discuss recent joint work with Szucs (arXiv:1805.12342) in which we give a similar description of the homotopy type of the classifying space of equivariant bordism categories.

Mike Hopkins (Harvard University)

Title: The motivic Freudenthal suspension theorem

Abstract: In topology, the Freudenthal suspension theorem connects the effective computational techniques in stable homotopy theory to problems of interest in ordinary homotopy theory. The analogue of this result in the homotopy theory of smooth varieties (motivic homotopy theory) has been elusive. In this talk I will describe recent joint work with Aravind Asok and Tom Bachmann, establishing the motivic Freudenthal suspension theorem. Time permitting I will survey some of the motivating and emerging applications.

Maxim Kontsevich (IHES)

Title: Semi-infinite topology of Chern-Simons theory
Abstract: Chern-Simons functional can be thought of as a cubic polynomial in infinitely many variables. I will explain how one can predict the monodromy structure on the "middle homology" of the complex level sets via resurgence of the quantum dilogarithm and counting of gradient trajectories of the classical dilogarithm. One can also see analogs of Hodge and weight filtrations in this "semi-infinite" limit of algebraic geometry.

Oscar Randal-Williams (University of Cambridge)

Title: Algebraic independence of topological Pontrjagin classes

Abstract: Classical results of Sullivan and Kirby–Siebenmann may be used to see that the map from the space BO (classifying stable vector bundles) to the space BTop (classifying stable bundles of Euclidean spaces) is a rational homotopy equivalence. Therefore the familiar Pontrjagin classes of vector bundles must arise from more mysterious invariants of bundles of Euclidean spaces. For bundles of d-dimensional Euclidean spaces, one may ask whether the identities among Pontrjagin classes familiar from d-dimensional vector bundles continue to hold. To everyone's great surprise, Weiss has shown that they need not. I will explain an elaboration of Weiss' results, using completely unrelated methods: there are no relations at all among (Euler and) Pontrjagin classes for bundles of d-dimensional Euclidean spaces, whenever $d \geq 4$. This is joint work with S. Galatius.

Claudia Scheimbauer (Tu München)

Title: A universal property of the higher category of spans and finite gauge theory as an extended TFT

Abstract: I will explain how to generalize Harpaz' universal property of the (infty, 1)-category of spans to the higher category thereof. Combining this with the finite path integral construction of Freed-Hopkins-Lurie-Teleman this yields finite gauge theory as a fully extended TFT. This is joint work in progress with Tashi Walde.