Mid-South Algebraic Topology and Geometry Workshop

Topics and Abstract

- Xing Gu
  Title: The ordinary and motivic cohomology of $BPGL_n(\mathbb{C})$
  Abstract: For an algebraic group G over $\mathbb{C}$, we have the classifying space BG in the sense of Totaro and Voevodsky, which is an object in the unstable motivic homotopy category that plays a similar role in algebraic geometry as the classifying space of a Lie group in topology. The motivic cohomology (in particular, the Chow ring) of BG is closely related, via the cycle map, to the singular cohomology of the topological realization of BG, which is the classifying space of $G(\mathbb{C})$, the underlying Lie group of the complex algebraic group G. In this talk we present a work which exploits the above connection between topological and motivic theory and yields new results on both the ordinary and the motivic cohomology of $BPGL_n(\mathbb{C})$, the complex projective linear group.

- André Henriques
  Title: The complex cobordism 2-category and its central extensions
  Abstract: I will introduce a symmetric monoidal 2-category whose objects are 0-manifolds, whose 1-morphisms are 1-dimensional smooth cobordisms, and whose 2-morphisms are Riemann surfaces with boundary and cusps. I will introduce a certain central extension by $\mathbb{R}_+$ and explain its relevance in chiral conformal field theory. Finally, I will explain the state of my understanding on the question of classification of such extensions by $\mathbb{R}_+$.

- Xiaowen Hu
  Title: Mirror symmetry of quadric hypersurfaces
  Abstract: We show mirror symmetry of quadric hypersurfaces, in terms of identification of the associated Frobenius manifolds. We will explain several key points: compactification and desingularization of Givental's mirror Landau-Ginzburg models, and the computation of the so-called broad periods, which mirror the quantum cohomology of quadric hypersurfaces involving the primitive cohomology class. We will also present some related unsolved problems.

- Hana Jia Kong
  Title: Calculations in the motivic stable homotopy category
  Abstract: Calculations in the motivic category are interesting and have close connections to number theory as well as classical stable homotopy theory. One example of motivic applications in the classical theory is the Adams spectral sequence computations by Isaksen—Wang—Xu. They base their approach on a theoretical result by Gheorghe—Wang—Xu about a t-structure on the p-complete cellular C-motivic category. I will first talk about a generalization of this result, joint with Tom Bachmann, Guozhen Wang, and Zhouli Xu. The generalization leads to computational applications in the classical and motivic Adams spectral sequences. Another important computational tool in the classical theory is the Adams–Novikov spectral sequence. I will talk about its motivic analog, the motivic slice spectral sequence, and how it computes the motivic 'image-of-j' spectrum defined by Bachmann–Hopkins. The slice computation is joint with Eva Belmont and Dan Isaksen. The comparison between the motivic slice spectral sequence and the motivic Adams spectral sequence parallels the classical Adams and Adams–Novikov spectral sequences.

- Chunyi Li

- Wen-Wei Li
  Title: Higher localization and applications to higher branching laws
  Abstract: Given a complex variety X on which a connected reductive group G acts, the localization functor is a simple recipe that produces D_X-modules from $\mathfrak{g}$-modules. This includes the well-known Beilinson-Bernstein localization for flag varieties as a particular case. In the first part of the work, I will present an equivariant and derived version of localization, which is best phrased in terms of h-complexes and h-derived categories of Beilinson-Ginzburg. It turns out that when X is an

affine spherical homogeneous space and K is a reductive spherical subgroup of G, the localizations of Harish-Chandra $(\mathfrak{g}, K)$-modules have regular holonomic cohomologies. In the second part of the talk, I will explain how higher localization can be applied to the study of higher branching laws, as proposed by Dipendra Prasad, in the algebraic context of $(\mathfrak{g}, K)$-modules. If time permits, I will also try to relate the algebraic and analytic pictures.

- Weinan Lin
  Title: Applications of Groebner basis in the algebraic topology
  Abstract: Gröbner basis is a great tool to handle finitely generated commutative algebras over a field and solve many problems about them. These problems includes computing the homology of a finitely generated differential graded algebra and the Ext groups of a commutative algebra. In this talk, I will introduce some basic algorithms on Gröbner basis and and explain how to use them to do many calculations in algebraic topology. I will also talk about my ongoing work of generalizing the theory of Gröbner bases to a wide range of non-commutative algebras including the Steenrod algebra.

- Kiran Luecke
  Title: Completed K theory and Equivariant Elliptic Cohomology
  Abstract: In this talk I will discuss a relatively simple geometric model for twisted equivariant elliptic cohomology at the Tate curve. The model is a completed version of S^1 equivariant K-theory, and has the benefit of reproducing the representation theory of loop groups without using it in the construction.

- Daniel Murfet

- Yun Shi
  Title: D-critical locus structure for local toric Calabi-Yau 3-folds
  Abstract: Donaldson-Thomas (DT) theory is an enumerative theory which produces a virtual count of stable coherent sheaves on a Calabi-Yau 3-fold. Motivic Donaldson-Thomas theory, originally introduced by Kontsevich-Soibelman, is a categorification of the DT theory. This categorification contains more refined information of the moduli space. In this talk, I will explain the role of d-critical locus structure in the definition of motivic DT invariant, following the definition by Bussi-Joyce-Meinhardt. I will also discuss results on this structure on the Hilbert schemes of zero dimensional subschemes on local toric Calabi-Yau threefolds. This is based on joint works with Sheldon Katz. The results have substantial overlap with recent work by Ricolfi-Savvas, but techniques used here are different.

- Nathaniel Stapleton
  Title: On the KU_G-local equivariant sphere
  Abstract: Equivariant complex K-theory and the equivariant sphere spectrum are two of the most fundamental equivariant spectra. In this talk, I will explain how to calculate the zeroth homotopy Green functor of the localization of the equivariant sphere spectrum with respect to equivariant complex K-theory, where the group of equivariance is a finite p-group and p is an odd prime. This is joint work with Peter Bonventre and Bert Guillou.

- Guozhen Wang
  Title: Topological cyclic homology of local fields
  Abstract: We introduce a new method for computing topological cyclic homology of locally complete intersections over p-adic intergers, by using relative hochschild homology and resolving the base ring spectrum with an Adams reslolution. Using the Nygaard filtration on the E1-term, we can construct algebraic Tate and algebraic homotopy fixed points spectral sequences, which are algebraic and catpture lots of informations in the Tate and homotopy fixed points spectral sequences computing TP and TC^{-1}. Using this method, we can give a uniform way of computing topological cyclic homology of local fields of mixed characteristic.

- Chenglong Yu
  Title: Commensurabilities among Lattices in $PU(1, n)$

Abstract: The study of hypergeometric functions dates back to Euler and Riemann. The global monodromy groups arising from analytic continuations of those functions play an important rule in their global properties. Many mathematicians including Fuchs, Schwarz, Picard, Pochhammer, Appell, Lauricella and Terada studied the corresponding period integrals and higher dimensional generalizations. In 1980's, Deligne and Mostow obtained complete discreteness and arithmeticity criteria for those monodromy groups acting on complex hyperbolic balls. Thurston also gave another approach via flat conic metrics. On the other hand, the classification of those groups up to conjugation and finite index (commensurability) is not completed. The dimension one case is the classical hyperbolic triangle groups and solved by work of Greenberg, Petersson, Singerman and Takeuchi. There are some commensurability results on dimension two case by Sauter and Deligne-Mostow.

In this talk, we will discuss some new results on commensurabilities among lattices in $PU(1, n)$ for higher dimension n. The results rely on constructions of higher dimensional varieties instead of analysis of complex reflection groups. This approach also gives new proofs for existing results in n=2. This is joint work with Zhiwei Zheng.

- Ningchuan Zhang
  Title: A Quillen-Lichtenbaum Conjecture for Dirichlet L-functions
  Abstract: The original version of the Quillen-Lichtenbaum Conjecture, proved by Voevodsky and Rost, connects special values of Dedekind zeta functions and algebraic K-groups of number fields. In this talk, I will discuss a generalization of this conjecture to Dirichlet L-functions. The key idea is to consider equivariant algebraic K-theory with coefficients in the characters. This is joint work in progress with Elden Elmanto.

- Lutian Zhao
  Title: Stability of Parahoric Higg Bundle
  Abstract: Parahoric Higgs bundle is a type of Higgs bundle that allows an introduction of wild singularity. Pararhoric G-Higgs bundle is similar to parabolic Higgs bundle where we replace the parabolic subgroup in the definition with a parahoric subgroup in the context of Bruhat-Tits. In this talk, I will describe the stability conditions motivated by the work of ramanathan, that prove to be important in establishing the non-Abelian Hodge correspondence in this setup. This is joint work with Pengfei Huang, Georgios Kydonakis, and Hao Sun.

- Yu Zhao
  Title: A Weak Categorification of the quantum toroidal algebra actions
  Abstrac: We will explain a new construction of a weak categorification of the quantum toroidal algebra action on the Grothendieck group of moduli space of stable (or framed) sheaves over an algebraic surface. At the level of K theory, this action is constructed by Schiffmann-Vasserot and Neguţ.