

Arithmetic and Topology, 2022

Scientific Committee: Stavros Garoufalidis

Organizers: Hui Gao, Yifei Zhu

Hosted by Dept. of Mathematics and the Shenzhen International Center for Mathematics at SUSTech.

website: <https://aritopo.github.io/>

All talks on zoom: 863 4229 4780

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	Dec. 16, Friday	Dec. 17, Saturday
08:50–09:00	Opening remarks	
09:00–09:50	Guozhen Wang	
10:00–10:50	Weiyan Chen	Ningchuan Zhang
11:00–11:50	Zhen Huan	Xing Gu
14:00–14:50	Yongquan Hu	Seokbeom Yoon
15:00–15:50	Haoran Wang	Zicheng Qian
16:00–16:50	Bin Zhao	Yiqin He

Title and Abstract.

Dec. 16, Friday

Title: Computations of topological cyclic homology

Speaker: Wang Guozhen

Abstract: Algebraic K -theory for a field is the classification of vector spaces including higher homotopical information. The cyclotomic trace map from algebraic K -theory to topological cyclic homology is a generalization of the Chern character which approximates K -theory by ordinary homology. We will give an introduction to some new developments in the methods for computing topological cyclic homology and its applications.

Title: TBA

Speaker: Weiyan Chen

Title: Twisted Real quasi-elliptic cohomology

Speaker: Zhen Huan

Abstract: Quasi-elliptic cohomology is closely related to Tate K -theory. It is constructed as an object both reflecting the geometric nature of elliptic curves and more practicable to study than most elliptic cohomology theories. It can be interpreted by orbifold loop spaces and expressed in terms of equivariant K -theories. We formulate the complete power operation of this theory. Applying that we prove the finite subgroups of Tate curve can be classified by the Tate K -theory of symmetric groups modulo a certain transfer ideal.

In this talk we construct twisted Real quasi-elliptic cohomology as the twisted KR -theory of loop groupoids. The theory systematically incorporates loop rotation and reflection. After establishing basic properties of the theory, we construct Real analogues of the string power operation of quasi-elliptic cohomology. We also explore the relation of the theory to the Tate curve. This is joint work with Matthew Young.

Title: Multivariable $(\varphi, \mathcal{O}_K^\times)$ -modules and mod p representations of GL_2

Speaker: Yongquan Hu

Abstract: Let p be a prime number, K a finite unramified extension of \mathbb{Q}_p , and π a smooth representation of $GL_2(K)$ on some Hecke eigenspace in mod p cohomology of Shimura curves. One can associate to π a multivariable $(\varphi, \mathcal{O}_K^\times)$ -module. The aim of this talk is to explain the construction and some recent results around it. This is joint work with C. Breuil, F. Herzig, S. Morra and B. Schraen.

Title: On some mod p representations of quaternion algebra over \mathbb{Q}_p

Speaker: Haoran Wang

Abstract: Scholze proposed a mod p Jacquet–Langlands correspondence for $GL(n, K)$, where K is a finite extension of \mathbb{Q}_p . I will discuss some results about Scholze’s functors in the case of $GL(2, \mathbb{Q}_p)$. This is a joint work with Yongquan Hu.

Title: Slopes of modular form and ghost conjecture

Speaker: Bin Zhao

Abstract: In 2016, Bergdall and Pollack raised a conjecture towards the computation of the p -adic slopes of Hecke cuspidal eigenforms whose associated p -adic Galois representations satisfy the assumption that their mod p reductions become reducible when restricted to the p -decomposition group. In this talk, I will report a joint work with Ruochuan Liu, Nha Truong and Liang Xiao to prove this conjecture under mild assumptions. I will first give the statement of this conjecture and explain the intuition behind its formulation. I will then explain some key strategies in our proof. If time permits, I will mention some arithmetic consequences of this conjecture.

Dec. 17, Saturday

Title: A Quillen–Lichtenbaum Conjecture for Dirichlet L -functions

Speaker: Ningchuan Zhang

Abstract: The original version of the Quillen–Lichtenbaum Conjecture, proved by Voevodsky and Rost, connects special values of the Dedekind zeta function of a number field with its algebraic K -groups. In this talk, I will discuss a generalization of this conjecture to Dirichlet L -functions. The key idea is to twist algebraic K -theory spectra of number fields with equivariant Moore spectra associated to Dirichlet characters. Rationally, we obtain a Quillen–Borel type theorem for Artin L -functions. This is joint work in progress with Elden Elmanto.

Title: The ordinary and motivic cohomology of $BPGL_n(\mathbb{C})$

Speaker: Xing Gu

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.

Title: Twisted Neumann–Zagier matrices and loop invariants

Speaker: Seokbeom Yoon

Abstract: Let M be a hyperbolic 3-manifold with cusps and F be its trace field. For a geometric or topological invariant of M that lies in F , it is natural to study its behavior under finite cyclic covers of M . In this talk, we focus on loop invariants, derived from perturbative Chern–Simons theory, and describe their behaviors under cyclic covers in terms of twisted Neumann–Zagier matrices. This is joint work with Stavros Garoufalidis.

Title: On Breuil–Schraen \mathcal{L} -invariants for GL_n

Speaker: Zicheng Qian

Abstract: The study of Breuil–Schraen \mathcal{L} -invariants is motivated by that of Steinberg case of p -adic Langlands correspondence. Many results are known for $GL_2(\mathbb{Q}_p)$ and $GL_3(\mathbb{Q}_p)$ due to work of Breuil, Ding and Schraen. In this talk, we sketch a few recent progress towards general GL_n .

Title: Parabolic Simple \mathcal{L} -invariants and Local–global Compatibility

Speaker: Yiqin He

Abstract: Let L be a finite extension of \mathbb{Q}_p and ρ_L be a potentially semistable noncrystalline p -adic representation of Gal_L such that the associated F -semisimple Weil–Deligne representation is absolutely indecomposable. Via a study of Breuil’s parabolic simple \mathcal{L} -invariants, we attach to ρ_L a locally \mathbb{Q}_p -analytic representation $\Pi(\rho_L)$ of $GL_n(L)$, which carries the exact information of the Fontaine–Mazur parabolic simple \mathcal{L} -invariants of ρ_L . When ρ_L comes from a patched automorphic representation of $G(\mathbb{A}_{F^+})$ (for a unitary group G over a totally real field F^+ which is compact at infinite places and GL_n at p -adic places), we prove under mild hypothesis that $\Pi(\rho_L)$ is a subrepresentation of the associated Hecke-isotypic subspace of the Banach spaces of (patched) p -adic automorphic forms on $G(\mathbb{A}_{F^+})$.