第三届海峡两岸算术几何研讨会

The 3rd Cross Strait Workshop on Arithmetic Geometry

中国科学技术大学

2023 年 8 月 19–22 日

Invited Speakers

Ke Chen	陈柯	南京大学
Miaofen Chen	陈苗芬	华东师范大学
Huy Dang		台湾理论科学研究中心
Heng Du	杜衡	清华大学丘成桐数学科学中心
Shizhang Li	李时璋	中国科学院数学与系统科学研究院 晨兴数学中心
Wen-Wei Li	李文威	北京大学
Zhiyuan Li	李志远	复旦大学上海数学中心
Sian Nie	聂思安	中国科学院数学与系统科学研究院
Xu Shen	申旭	中国科学院数学与系统科学研究院 晨兴数学中心
Koji Shimizu		清华大学丘成桐数学科学中心
Yasuhiro Terakado	寺门康裕	Tokyo Denki University
Özge Ülkem		Academia Sinica
Yupeng Wang	王宇鹏	中国科学院数学与系统科学研究院 晨兴数学中心
Zhiyou Wu	吴峙佑	北京大学
Liang Xiao	肖梁	北京大学
Daxin Xu	许大昕	中国科学院数学与系统科学研究院 晨兴数学中心
Fei Xu	徐飞	首都师范大学
Chen Zhao	赵晨	中国科学技术大学
Kang Zuo	左康	武汉大学

Organizers

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Jiangwei Xue	薛江维	武汉大学
Chia-Fu Yu	余家富	Academia Sinica

Information

Conference Venue: Lecture hall 2105, Second teaching building, East campus[1]; 东校区第二教学楼 2105 报告厅

Lunch and Dinner: Guesthouse 2nd floor, 专家楼二楼自助餐厅

Banquet: 4th floor, Yueya Jiangnanchun Hotel, Post-docs and faculty members only; 江南春 4 楼，仅限参会老师（含博士后）

资助: 此次会议由中国科学院稳定支持基础研究领域青年团队项目资助

[1]Please see the map on page 17.

Conference Schedule

Aug. 19th, Saturday	
10:45–11:45	Zhiyuan Li　李志远 *Beauville-Voisin filtration and Bloch's conjecture on hyper-Kähler varieties of* $\mathrm{K3}^{[n]}$ *type*
11:45–14:00	Lunch Break

14:00–15:00	Koji Shimizu *Moduli stacks of crystals and isocrystals*
15:00–15:15	Break
15:15–16:15	Shizhang Li　李时璋 *Estimate Frobenius height for pushforwards of prismatic* F*-crystals*
16:15–16:30	Break
16:30–17:30	Heng Du　杜衡 *A purity result for semi-stable local systems*
17:30–19:30	Dinner

Aug. 20th, Sunday	
09:30–10:30	Liang Xiao 肖梁 *Slopes of modular forms and ghost conjecture of Bergdall-Pollack*
10:30–10:45	Group Photo
10:45–11:00	Break
11:00–12:00	Miaofen Chen 陈苗芬 *Harder-Narasimhan stratification in p-adic Hodge theory*
12:00–14:00	Lunch Break

14:00–15:00	Sian Nie 聂思安 *Steinberg's cross-sections and loop Deligne-Lusztig varieties*
15:00–15:15	Break
15:15–16:15	Yasuhiro Terakado 寺门康裕 *Mass formulas and the basic locus of unitary Shimura varieties*
16:15–16:30	Break
16:30–17:30	Zhiyou Wu 吴峙佑 *Categorical local Langlands*
17:30–19:30	Banquet

Aug. 21st, Monday	
09:30–10:30	Kang Zuo 左康 *Constructing families of abelian varieties of* GL_2*-type over 4 punctured complex projective line via p-adic Hodge theory and Langlands correspondence*
10:30–10:45	Break
10:45–11:45	Xu Shen 申旭 *Higgs bundles, F-zips, and dual BGG complexes*
11:45–14:00	Lunch Break

14:00–15:00	Daxin Xu 许大昕 *Frobenius slopes and Hodge filtration of hypergeometric differential equations*
15:00–15:15	Break
15:15–16:15	Huy Dang *Swan conductor and the refined lifting problem*
16:15–16:30	Break
16:30–17:30	Yupeng Wang 王宇鹏 *Integral p-adic Simpson correspondence for small representations*
17:30–19:30	Dinner

Aug. 22nd, Tuesday	
09:30–10:30	Wen-Wei Li　李文威 *On branching laws and their homological analogues*
10:30–10:45	Break
10:45–11:45	Özge Ülkem *Generalized $\mathcal{D}$-elliptic sheaves*
11:45–14:00	Lunch Break

14:00–15:00	Ke Chen　陈柯 *On the Coleman-Oort conjecture for Shimura subvarieties*
15:00–15:15	Break
15:15–16:15	Chen Zhao　赵晨 *L^2-extension of adjoint bundles and Kollar's conjecture*
16:15–16:30	Break
16:30–17:30	Fei Xu　徐飞 *Arithmetic of Markoff surfaces*
17:30–19:30	Dinner

Titles and Abstracts

Beauville-Voisin filtration and Bloch's conjecture on hyper-Kähler varieties of $K3^{[n]}$ type

Zhiyuan Li 李志远
复旦大学上海数学中心

Aug. 19th, 10:45–11:45

In this talk, I will discuss the recent progress on studying zero cycles on moduli space of stable objects on K3 surfaces. This includes the construction of BV filtrations on such moduli spaces and its applications to Bloch's conjecture. I will focus on the connection between BV filtrations on K3 surfaces and higher dimensional hyper-Kähler varieties of $K3^{[n]}$ type. At the end, I will explain how to generalize Huybrechts' work and prove Bloch's conjecture for (anti)-symplectic autoequivalences on K3 surfaces with Picard number > 2. This is joint with R. Zhang, X. Yu-R. Zhang.

Moduli stacks of crystals and isocrystals

Koji Shimizu
清华大学丘成桐数学科学中心

Aug. 19th, 14:00–15:00

To a smooth projective curve over a finite field, we associate rigid-analytic moduli stacks of isocrystals together with the Verschiebung endomorphism. We discuss the first examples and properties of such objects. This is a joint work in progress with Gyujin Oh.

Estimate Frobenius height for pushforwards of prismatic F-crystals

Shizhang Li 李时璋
中国科学院数学与系统科学研究院晨兴数学中心

Aug. 19th, 15:15–16:15

Prismatic F-crystals are coefficients for prismatic cohomology theory, like how local system is to étale cohomology theory. In this analogy, Frobenius height of a prismatic F-isocrystal is similar to the notion of weight (of a local system). In joint work with Haoyang Guo, we show that i-th derived pushforward by a smooth proper map will at most enlarge the range of Frobenius height by i, which can be considered as a prismatic analog of Deligne's Weil 2 (as well as Kedlaya's p-adic Weil 2).

A purity result for semi-stable local systems

Heng Du 杜衡
清华大学丘成桐数学科学中心

Aug. 19th, 16:30–17:30

Tsuji proved a purity result for crystalline local systems, stating that any de Rham local system over the adic generic fiber of a small formal base is crystalline if and only if its restriction to a certain nonclassical point is crystalline. This talk will present a logarithmic generalization of this result. We will discuss how our proof is connected to prismatic F-crystal classifications of semi-stable local systems. This talk is based on joint work with Tong Liu, Yong Suk Moon, and Koji Shimizu.

Slopes of modular forms and ghost conjecture of Bergdall-Pollack

Liang Xiao 肖梁
北京大学

Aug. 20th, 9:30–10:30

Fix a prime number p. The p-adic slope of a modular eigenform is the p-adic valuation of the eigenvalue for the action of the U_p-operator. The study of p-adic slopes is pioneered by many works of Gouvea and Mazur in 1990s and is closely related to eigencurves introduced by Coleman and Mazur. There are many conjectures in this direction, and are mostly all unified by a recent conjecture by Bergdall and Pollack, called the ghost conjecture. We report a recent progress in this direction where we prove this ghost conjecture under a mild technical assumption. This is a joint work with Ruochuan Liu, Nha Truong, and Bin Zhao.

Harder-Narasimhan stratification in p-adic Hodge theory

Miaofen Chen 陈苗芬
华东师范大学

Aug. 20th, 11:00–12:00

We will talk about the construction of Harder-Narasimhan stratification on the $\mathrm{B}_{\mathrm{dR}}^{+}$-Grassmannian and study its basic geometric properties and relation with other stratifications. This is a joint work in progress with Jilong Tong.

Steinberg's cross-sections and loop Deligne-Lusztig varieties

Sian Nie 聂思安
中国科学院数学与系统科学研究院

Aug. 20th, 14:00–15:00

Loop Deligne-Lusztig varieties (LDLVs for short) were first introduced by Lusztig, whose cohomology are expected to realize interesting representations of p-adic groups. For general linear groups, by studying LDLVs of Coxeter type, Boyarchenko, Weinstein, Chan and Ivanov obtained a purely local and geometric realization for a large class of local Langlands and Jaquet-Langlands correspondences. In this talk, we will discuss a generalization of their results to other reductive groups. A key ingredient is a loop group version of Steinberg's cross-sections.

Mass formulas and the basic locus of unitary Shimura varieties

Yasuhiro Terakado 寺门康裕
Tokyo Denki University

Aug. 20th, 15:15–16:15

A Shimura variety of PEL type is a moduli space of abelian varieties with additional structures. Its mod-p reduction naturally decomposes into finitely many "Newton strata", which are given by the isogeny classes of the p-divisible groups of abelian varieties. There is a unique closed Newton stratum, called the basic locus. In this talk we study the geometry and arithmetic of the basic locus of the $\mathrm{GU}(r,s)$-Shimura variety associated with an imaginary quadratic field. We discuss mass formulas for abelian varieties on the basic locus, and compute the number of the irreducible components. This is joint work with Chia-Fu Yu.

Categorical local Langlands

Zhiyou Wu 吴峙佑
北京大学

Aug. 20th, 16:30–17:30

The local Langlands correspondence is a conjectural relation between sets of smooth representations and Langlands parameters, which has recently been upgraded to categorical equivalences by Fargues-Scholze/Xinwen Zhu in two different ways. I will describe my work in progress on comparing these two categories.

Constructing families of abelian varieties of GL_2-type over 4 punctured complex projective line via p-adic Hodge theory and Langlands correspondence

Kang Zuo 左康
武汉大学

Aug. 21st, 9:30–10:30

This is a joint work with Jinbang Yang. We construct infinitely many non-isotrivial families of abelian varieties of GL_2-type over complex four punctured projective lines with bad reduction of type-$(1/2)\infty$ via p-adic Hodge theory and Langlands correspondence. They lead to algebraic solutions of the Painleve VI equation. Recently Lin-Sheng-Wang proved the conjecture on the torsioness of zeros of Kodaira-Spencer maps of those type families. Based on their theorem we show the set of those type families of abelian varieties is *exactly* parameterized by torsion sections of the universal family of elliptic curves modulo the involution.

Higgs bundles, F-zips, and dual BGG complexes

Xu Shen 申旭
中国科学院数学与系统科学研究院晨兴数学中心

Aug. 21st, 10:45–11:45

We will discuss mod p non-abelian Hodge theory in the setting of good reductions of Shimura varieties (and their toroidal compactifications). Here, two special constructions come to interact with the general theory: F-zips with additional structure (with the associated Ekedahl-Oort stratification, Hasse invariants, etc) and the dual BGG complexes of automorphic vector bundles. We will make an attempt to clarify some basic relations between such objects.

Frobenius slopes and Hodge filtration of hypergeometric differential equations

Daxin Xu 许大昕
中国科学院数学与系统科学研究院晨兴数学中心

Aug. 21st, 14:00–15:00

In this talk, we will study the irregular Hodge filtration of hypergeometric equations and the Frobenius slopes of the Frobenius structure of these equations. We will present a "Newton equals to Hodge" result for certain hypergeometric sums. This talk is based on a joint work with Yichen Qin.

Swan conductor and the refined lifting problem

Huy Dang
台湾理论科学研究中心

Aug. 21st, 15:15–16:15

In this talk, we discuss the current state of the refined lifting problem for Galois covers of curves. Our main focus is on the refined Swan conductor, which serves as a key tool in addressing this problem. Specifically, we will introduce our conjecture proposing an algorithm to calculate the refined Swan conductor of cyclic characters in mixed characteristic. This algorithm extends a well-known one used in equal-characteristic p situations and incorporates previously unpublished work by Sekiguchi and Suwa.

Integral p-adic Simpson correspondence for small representations

Yupeng Wang 王宇鹏
中国科学院数学与系统科学研究院晨兴数学中心

Aug. 21st, 16:30–17:30

The p-adic Simpson correspondence concerns about the conjectural equivalence between the category of (certain) representations of the fundamental group of a p-adic variety X and the category of (certain) Higgs bundles on X. In 2005, Faltings established such an equivalence for "small objects" with $\mathbb{Q}_p$-coefficients, and his method was then elaborated and generalized systematically by Abbes-Gros and Tsuji. In this talk, we will upgrade Faltings' equivalence to the integral level. This is a joint work with Yu Min.

On branching laws and their homological analogues

Wen-Wei Li 李文威
北京大学

Aug. 22nd, 9:30–10:30

I will give a brief introduction to the topic called "branching law" in representation theory of Lie groups, in both the real and p-adic settings. The emphasis will be on their homological analogs, which could also be viewed as higher branching laws. I will talk about some of my recent results that relate higher branching laws to higher localizations, which involve $\mathcal{D}$-modules. The talk is intended for general audiences.

Generalized $\mathcal{D}$-elliptic sheaves

Özge Ülkem
Academia Sinica

Aug. 22nd, 10:45–11:45

Drinfeld introduced the notion of *elliptic modules*, which are now called Drinfeld modules, as an analogue of elliptic curves in the function field setting. To prove Langlands correspondence, Drinfeld studied moduli spaces of elliptic sheaves. Since then, many generalizations of elliptic sheaves have been studied, such as $\mathcal{D}$-elliptic sheaves defined by Laumon, Rapoport, Stuhler and Frobenius-Hecke sheaves defined by Stuhler. In this talk, I will introduce a new generalization, called *generalized $\mathcal{D}$-elliptic sheaf*. In the first part, I will make a brief introduction to function field arithmetic and I will define generalized $\mathcal{D}$-elliptic sheaves. In the second part, I will present some basic results on their moduli spaces, building on work of Laumon-Rapoport-Stuhler, of Hartl and of Rapoport-Zink. I will also state a uniformization theorem of the moduli space of generalized $\mathcal{D}$-elliptic sheaves and talk about the proof if time permits.

On the Coleman-Oort conjecture for Shimura subvarieties

Ke Chen 陈柯
南京大学

Aug. 22nd, 14:00–15:00

The Coleman-Oort conjecture predicts that the open Torelli locus in the Siegel moduli space of g-dimensional abelian varieties should not contain any dense subset of Shimura subvarieties of strictly positive dimension, at least when g is large enough. We discuss various cases of this conjecture using geometry of surface fibrations, based on joint works with Kang Zuo and Xin Lv.

L^2-extension of adjoint bundles and Kollar's conjecture

Chen Zhao 赵晨
中国科学技术大学

Aug. 22nd, 15:15–16:15

I will talk about Kollar's package on the derived pushforward of the L^2-extension of the dualizing sheaf twisted by a certain Hermitian vector bundle. In particular we give an L^2-theoretic proof to Kollar's conjecture, which has been proved by M. Saito via the theory of mixed Hodge modules. This is a work joint with Junchao Shentu.

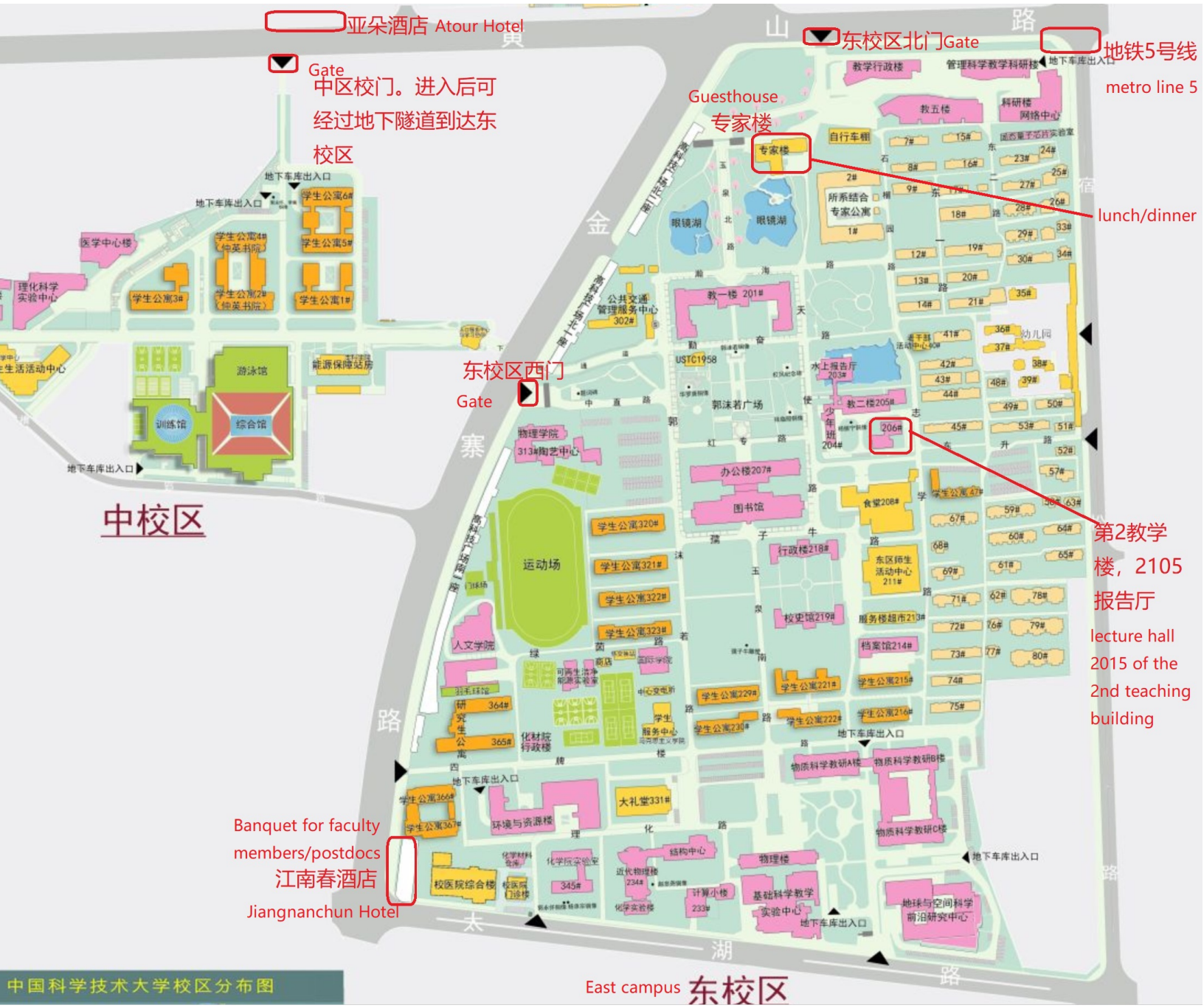
Arithmetic of Markoff surfaces

Fei Xu 徐飞
首都师范大学

Aug. 22nd, 16:30–17:30

The integral solutions of Markoff surfaces has been studied by Markoff, Hurwitz, Mordell, ..., etc, and more recently by Ghosh and Sarnak. In this talk, we will study integral points of Markoff surfaces from geometric point of view by using Brauer-Manin obstruction and prove that any Markoff surface does not satisfy strong approximation with Brauer-Manin obstruction. Part of this work has also been obtained by Loughran and Mitankin independently. This is a joint work with Colliot-Thélène and Dasheng Wei.

Locations


亚朵酒店 Atour Hotel
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东校区北门Gate
地铁5号线
metro line 5
Guesthouse
专家楼
lunch/dinner
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Gate
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第2教学楼，2105报告厅
lecture hall 2015 of the 2nd teaching building
Banquet for faculty members/postdocs
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