

p-adic Arithmetic and Geometry

Handbook Last updated: 2024 年 1 月 11 日

Conference Time: January 12-14, 2024.

Place: M1001, located on 1st Floor of College of Science Building.

Scientific Committee: Ruochuan Liu

Organizers: Gao Hui, Hu Yong, Qiu Yannan

Website: <https://huigaomath.github.io/arithgeom2024.html>

Please note **special time** on Friday.

Time	Jan.12	Time	Jan.13	Jan.14
09:45– 10:45	Kang ZUO	09:45– 10:45	Shizhang LI	Longke TANG
10:45– 11:05	☕ (<i>tea break</i>)	10:45– 11:15	☕	☕
11:05– 12:05	Mao SHENG (special time!)	11:15– 12:15	Yong-Suk MOON	Lei ZHANG
14:30– 15:30	Yichao TIAN		Free discussions	END
15:30– 16:00	☕		no tea	
16:00– 17:00	Runhong ZONG			

§. Title and Abstract.

Jan. 12, Friday

Title: p -adic Simpson correspondence, motivic Higgs bundles and Katz middle convolution.

Speaker: Kang ZUO

Abstract: I shall explain the recent joint work with Jinbang Yang on constructing rank-2 motivic local systems on 4-punctures projective line over complex numbers via motivic Higgs bundles. The proof relies on p -adic Simpson correspondence for periodic Higgs bundles, Deligne's p to ℓ companions, Yu's work on numerical characteristic p Simpson correspondence, Drinfeld's work on Langlands correspondence over function field of characteristic- p and Grothendieck-Messing deformation theorem for log abelian schemes. It is remarkable, recently Lam-Litt provided a totally different approach to the above results by using Katz middle convolution.

Title: Transversal foliations in positive characteristic

Speaker: Mao SHENG

Abstract: In this talk, I shall speak on a correspondence between the category of transversally foliated log smooth varieties over a fixed base in positive characteristic and the category of Higgs enhanced log smooth varieties over the same base. Stability for these objects will be also introduced.

Title: Geometry of unitary Shimura varieties and arithmetic applications

Speaker: Yichao TIAN

Abstract: Let F be an imaginary quadratic extension, and p be a prime inert in F . For an even integer n , let G be a unitary group G for F/\mathbb{Q} of signature $(n-1, 1)$. In this talk, I will explain the characteristic p geometry of the unitary Shimura variety attached to G of Siegel parahoric level at p , and how to use it to establish an unramified level raising result for unitary Shimura varieties of even rank, which is a key geometric part in my recent joint work with Yifeng Liu and Liang Xiao on the anticyclotomic Iwasawa main conjecture for Rankin-Selberg motives.

Title: New anabelian phenomena for curves in positive characteristic

Speaker: Runhong ZONG

Abstract: In the 1980s, in his famous letter to Faltings, Grothendieck suggested a theory which he called "anabelian geometry". This theory aims to reconstruct algebraic varieties from their algebraic fundamental groups (e.g. étale, tame, etc.). In the particular case of curves, Grothendieck's anabelian philosophy has provided a blueprint for the development of anabelian geometry (especially, for curves over arithmetic fields of characteristic 0) and has continuously guided the advancement of the theory until today.

In this talk, I will first outline some historical background and explain some key results, particularly emphasizing the significant contributions to anabelian geometry made by the Japanese school led by S. Mochizuki and A. Tamagawa. Following that, I will introduce a completely new anabelian phenomenon concerning curves in positive characteristic. This phenomenon is the first anabelian phenomenon that

cannot be explained by using Grothendieck's original anabelian philosophy. Moreover, further study of this phenomenon provides an important basis for constructing a general theory for anabelian geometry of curves over algebraically closed fields of characteristic p .

This is a joint work with Zhi Hu (NJUST, Nanjing) and Yu Yang (RIMS, Kyoto).

Jan. 13, Saturday

Title: General relative Poincaré duality in non-archimedean geometry

Speaker: Shizhang LI

Abstract: In this talk we'll explain a strategy to deduce general relative Poincaré duality in p -adic geometry in a diagrammatic manner, whose special cases were previously obtained respectively by Lan-Liu-Zhu, Gabber-Zavvalov, Mann, which was conjectured by Bhatt-Hansen. This is a joint work in preparation with Emanuel Reinecke and Bogdan Zavyalov.

Title: Purity for p -adic Galois representations

Speaker: Yong Suk MOON

Abstract: We will discuss certain purity results for geometric families of p -adic Galois representations. The talk is based on joint work with Heng Du, Tong Liu, Koji Shimizu.

Jan. 14, Sunday

Title: \mathbb{P}^1 -motivic Gysin map

Speaker: Longke TANG

Abstract: Recently, Annala, Hoyois, and Iwasa have defined and studied the \mathbb{P}^1 -motivic homotopy theory, a generalization of \mathbb{A}^1 -motivic homotopy theory that does not require \mathbb{A}^1 to be contractible, but only requires pointed \mathbb{P}^1 to be invertible. This makes it applicable to non- \mathbb{A}^1 -invariant cohomology theories such as Hodge, de Rham, and prismatic. I will recall basic facts in their theory, and construct the \mathbb{P}^1 -motivic Gysin map, thus giving a uniform construction for the Gysin maps of the above cohomology theories that are automatically functorial. If time permits, I will also use this Gysin map to prove prismatic Poincaré duality.

Title: Frobenius Descent and Drinfeld's Lemma

Speaker: Lei ZHANG

Abstract: Drinfeld's lemma plays a very important role in V. Lafforgues's work on Langlands correspondence over a global function field. A key ingredient of Drinfeld's lemma is the "permanence property" of certain algebro-geometric objects, meaning that the étale fundamental groups of those algebro-geometric objects are stable under base change of algebraically closed fields. The permanence property is a consequence of a descent phenomenon called "Frobenius descent". In this talk, I will first recall the proof Drinfeld's lemma for schemes over finite fields, then I will show that the statement can be vastly generalized, e.g. the ambient scheme can be generalized to very general fibered categories (including all types of stacks) and finite étale covers can be replaced by quasi-compact quasi-separated étale maps etc.. If time permit, I will also survey on some other recent developments.

§. Accommodation and Transportation.

中文版 (Chinese version.) (cf. later for English version.)

HOTEL info.

Faculties and postdocs:

君璞酒店:

Address: 南山区留仙大道 3333 号塘朗城西区 C 座 6-16 楼。

入住方式: 报自己姓名, 说南科大数学系预订的即可

Hotel phone number: (0755)27776988

6pm 之后到达, 最好和酒店打个招呼保留预约。

Students:

雅园塘朗酒店 (深圳西丽南科大店):

地址: 深圳市南山区学苑大道 1133-1 号

可以打车; 或者地铁到塘朗站之后步行

入住方式: 报自己姓名, 说南科大数学系预订的即可

联系电话:(0755)22233030

6pm 之后到达, 最好和酒店打个招呼保留预约。

机场/火车站去君璞酒店 强烈建议打车直接到酒店。从塘朗地铁站找到酒店会花费一些时间; 因为酒店位于一个复杂的 mall 内部。

如果是坐地铁到达, 不要按照高德地图指示, 而是从塘朗地铁站 A 出口直接进入塘朗城, 往右前方走, 进入乐购超市和万宁之间的走道, 然后左转, 可以看到君璞酒店的广告牌, 广告牌左边即为酒店的电梯, 乘坐电梯到 7 楼, 7 楼为前台大厅及餐厅。如果乘坐计程车, 直接到酒店 1 楼门口 (背向留仙大道一侧), 乘坐电梯上 7 楼。

从酒店到报告厅

1. 找到南科大 1 号门 (见下图。)
2. 秘书会提前通知大家申报 QR 进校码。可以进校门。
3. 步行过桥就到了理学院。理学院有个楼之间天桥, 那里右转最近的入口就是数学系 1 楼。
4. 实在找不到就找到瑞幸咖啡, 那里紧挨着数学系。



秘书电话

- Leyuan Shen: the secretary in charge of hotel and campus entrance. 17688530946
- Yaoming Cao: the secretary in charge of invitation letter and re-reimbursement. 13940254925

§. Accommodation and Transportation.

[English Version](#)

HOTEL info.

Faculties and postdocs:

Genpla Hotel (Pronounced as JunPu Hotel in Chinese.) 君璞酒店:

Address: Shenzhen City LiuXian Road No. 3333. 南山区留仙大道 3333 号塘朗城西区 C 座 6-16 楼。

Stay-in method: Tell them your name and that you have a room reserved by the math department

Hotel phone number: (0755)27776988

If you arrive after 6pm, it is better to let us know, so we can keep the reservation.

Airport/Train Station to Genpla Hotel:

International Guests (if you do not speak Chinese). We strongly recommend taking a Taxi.

Notes to Taxi driver: Please bring me to Junpu (Genpla) Hotel.

Chinese: 请带我去深铁塘朗城君璞酒店。靠近塘朗地铁站。准确地址：南山区留仙大道 3333 号塘朗城西区 C 座 6-16 楼。

[From Hotel to workshop Lecture room.](#)

The workshop will take place in Room M1001 of Math Department in the Science building.



1. It should be easy to locate TangLang metro station (it is close to JunPu hotel); circled in bottom of picture.
2. go north and follow the obvious road leading to Main Gate 1 of SUSTech.
3. See below for getting inside SUSTech through Gate 1.
4. Once inside, pass the bridge in front of you, then you are at Science Building. There is an *overpass* between two buildings and the RHS is the entrance to **Math Dept**. Room M1001 is on the 1st floor of Math Department.

How to get into SUSTech campus:

1. International Guests.

- if you use wechat, our secretary will help you to set up some QR code to get in campus.
- if you do NOT use wechat, try showing your passport to entrance guard at the gate and saying you are visiting Dept of Mathematics. Maybe they don't speak English... in the worst case, you can try asking students walking by.
- Another helpful item. Show entrance guard my ID picture.



Some Phone numbers; in case wechat does not work fast enough for you.

- Leyuan Shen: the secretary in charge of hotel and campus entrance. 17688530946
- Yaoming Cao: the secretary in charge of invitation letter and re-reimbursement. 13940254925