NANJING UNIVERSITY (5TH KYOTO⁺) CONFERENCE ON ALGEBRAIC GEOMETRY AND ARITHMETIC GEOMETRY

Date: 24 August-28 August, 2023 (Chinese Local Time, GMT+8)

Place: Department of Mathematics, Nanjing University and Zoom

Zoom Information:

Link: https://us04web.zoom.us/j/3782916777?pwd=eFZ5Vm1wY2pBRERNc2RBT24wcGJ0Zz09
ID: 378 291 6777
PW: w6gN0t

Speakers:

Li Cai (Capital Normal University)
Yiwen Ding（Peking University）
János Kollár (Princeton University)
Shizhang Li (Chinese Academy of Sciences)
Yifeng Liu（Zhejiang University）
Yuchen Liu (Northwestern University)
Emanuel Reinecke（MPIM-Bonn）
Junliang Shen (Yale university）
Koji Shimizu（Tsinghua University）
Carlos Simpson（CNRS and Université Côte d'Azur）
Burt Totaro（UCLA）
Jilong Tong (Capital Normal University)
Yichao Tian (Chinese Academy of Sciences)
Chenyang Xu (Princeton University)
Deding Yang（Peking University）
Xinyi Yuan (Peking University)
Bin Zhao (Capital Normal University）

Organizers: Yuichiro Hoshi (RIMS, Kyoto), Zhi Hu (NJUST, Nanjing), Pengfei Huang (Universität Heidelberg, Heidelberg), Yu Yang (RIMS, Kyoto), Runhong Zong (NJU, Nanjing)

See https://www.kurims.kyoto-u.ac.jp/~yuyang/confer.html for previous conferences.

Titles and Abstracts

Li Cai (Capital Normal University)

Title: On the Archimedean arithmetic smooth matching
Abstract: We will firstly talk about the relative trace formula approach to the Gross-Zagier formula, especially the Archimedean arithmetic smooth matching. Then we discuss a general problem reducing the semi-global comparison to the local one. The talk is based on two joint works: one with Ye Tian, Xinyi Yuan and Wei Zhang, and the other one with Ye Tian.

Yiwen Ding（Peking University）

Title: The geometry of Bernstein eigenvarieties
Abstract: Bernstein eigenvarieties are rigid analytic spaces parametrizing certain p-adic automorphic representations. Generalizing the work of Breuil-Hellmann-Schraen, we show that the geometry of Bernstein eigenvarieties is closely related to the generalized (parabolic) Grothendieck-Springer resolution. As an application, we prove a classicality result (in the Fontaine-Mazur style) of points on Bernstein eigenvarieties. This is a joint work with Christophe Breuil.

János Kollár (Princeton University)

Title: What determines an algebraic variety?
Abstract: We discuss how to describe the sheaf theory of an algebraic variety, if we are given only the underlying Zariski topological space. (Joint work with Max Lieblich, Martin Olsson and Will Sawin).

Shizhang Li (Chinese Academy of Sciences)

Title: On cohomology of $B^n G$
Abstract: We'll discuss the de Rham or crystalline or prismatic cohomology of $B^n G$ where G is a finite locally free commutative group scheme over a suitable base so that these cohomologies make sense. We will see that these cohomologies "want to be" (but not quite) derived augmented divided power algebra freely generated by Dieudonné module of G in degree $(n+1)$. This is an ongoing joint work with Dmitry Kubrak and Shubhodip Mondal.

Yifeng Liu（Zhejiang University）

Title: Selmer theta lifts
Abstract: We construct Kudla's generating functions valued in Selmer groups, and prove its modularity under certain conditions. We then define Selmer theta lifts and compute their p-adic heights, which can be regarded as a p-adic analogue of the arithmetic inner product formula.

Yuchen Liu (Northwestern University)

Title: Wall crossing for K-moduli spaces
Abstract: Recent developments in K-stability provide a nice moduli space, called a K-moduli space, for log Fano pairs. When the coefficient of the divisor varies, these K-moduli spaces demonstrate wall crossing phenomena. In this talk, I will discuss the general principle of K-moduli wall crossings, and show in examples that it provides a bridge connecting various moduli spaces of different origins, such as GIT, KSBA, and Hodge theory. Based on joint works with Kenny Ascher and Kristin DeVleming.

Emanuel Reinecke（MPIM-Bonn）

Title: Unipotent homotopy theory of schemes
Abstract: In this talk, I will present a notion of unipotent homotopy theory for schemes, which is based on Toen's work on affine stacks. I will discuss some general properties of the resulting unipotent homotopy group schemes and explain how over a field of characteristic $p > 0$, they often recover the unipotent completion of the Nori fundamental group scheme, p-adic etale homotopy groups, and Artin-Mazur formal groups. As examples, we will see computations in the case of curves, abelian varieties, and Calabi-Yau varieties. Joint work with Shubhodip Mondal.

Junliang Shen (Yale university）

Title: Perverse filtrations, compactified Jacobians, and Hitchin systems
Abstract: The cohomology of the Hitchin moduli space exhibits striking similarities to the cohomology of the compactified Jacobian of a curve with a planar singularity. Remarkably, both cohomology groups possess perverse filtrations. In the Hitchin scenario, the $P = W$ conjecture, which has now been established as a theorem, establishes a link between the perverse filtration and the mixed Hodge structure of the corresponding character variety through the non-abelian Hodge theory. In the Jacobian case, the Oblomkov-Rasmussen-Shende conjecture predicts a connection between the perverse filtration and the link of the curve singularity. In this talk, we will delve into a unified approach aimed at undastanding the perverse filtrations in both cases. This approach not only offers a proof of the $P = W$ conjecture but also establishes the multiplicativity of the perverse filtration of a compactified Jacobian, thereby generalizing a theorem of Oblomkov-Yun. Based on ongoing joint work with Davesh Maulik and Qizheng Yin.

Koji Shimizu（Tsinghua University）

Title: Moduli stacks of crystals and isocrystals
Abstract: 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.

Carlos Simpson（CNRS and Université Côte d'Azur）

Title: The Donagi-Pantev program for geometric Langlands on a curve of genus 2

Abstract: Let X be a Riemann surface. To a representation of the fundamental group, the geometric Langlands correspondence associates a perverse sheaf on the moduli space Bun of vector bundles. This perverse sheaf yields a representation of the fundamental group of a Zariski open subset of Bun. Ron Donagi and Tony Pantev made conjectures and initiated a program of analyzing this relationship using the nonabelian Hodge correspondence between Higgs bundles and representations of fundamental groups. Their picture is related to the "electro-magnetic duality" of Kapustin and Witten. We'll explain the Donagi-Pantev program, its relation to the nonabelian Hodge correspondence, and then discuss our current work on this project for the case of rank 2 local systems on a curve of genus 2.

Burt Totaro（UCLA）

Title: Endomorphisms of varieties
Abstract: A natural class of dynamical systems is obtained by iterating polynomial maps, which can be viewed as maps from projective space to itself. One can ask which other projective varieties admit endomorphisms of degree greater than 1. This seems to be an extremely restrictive property, with all known examples coming from toric varieties (such as projective space) or abelian varieties. We describe what is known in this direction, with the new ingredient being the "Bott vanishing" property. Joint work with Tatsuro Kawakami.

Jilong Tong (Capital Normal University)

Title: Harder-Narasimhan stratification in p-adic Hodge theory
Abstract: We will construct the Harder-Narasimhan stratification on the B_{dR}^+-Grassmannian and study its basic geometric properties, such as non-emptiness, dimension and relation with other stratifications. This generalizes the work of Dat-Orlik-Rapoport, Cornut-Peche Irissarry, Nguyen-Viehmann and Shen. This is a joint work in progress with Miaofen Chen.

Yichao Tian (Chinese Academy of Sciences)

Title: A prismatic-etale comparison theorem in the semi-stable case
Abstract: Various p-adic comparison theorems are important topics in p-adic Hodge theory. In recent years, the prismatic cohomology theorem introduced by Bhatt and Scholze provide us with a uniform framework to compare various p-adic cohomology theories. In this talk, I will explain a p-adic comparison theorem between the prismatic cohomology for F-crystals and the étale cohomology for local systems on semistable p-adic formal schemes over the ring of integers of a p-adic fields.

Chenyang Xu (Princeton University)

Title: Higher rank finite generation
Abstract: Finite generation for higher rank quasi-monomial valuation plays a key role in K-stability theory of Fano varieties. It is the main step to establish the "compactedness".

In this talk, we want to outline our proof of it. The talk is based on joint works with Yuchen Liu and Ziquan Zhuang.

Deding Yang（Peking University）

Title: Ampleness of automorphic line bundles over Hilbert modular varieties and some generalizations
Abstract: Let F be a totally real field in which p is unramified and let S denote the integral model of the Hilbert modular variety with good reduction at p. Let $\omega^{\underline{t}} = \otimes_\tau \omega_\tau^{t_\tau}$ denote the usual modular line bundle over S. On the generic fiber, it is well known that $[\omega^{\underline{t}}] \in \mathrm{Pic}(S_\eta)_{\mathbb{Q}}$ is ample if and only if $t_\tau > 0$ for all $\tau \in \Sigma_\infty$. On the special fiber, it is conjectured in [Tian-Xiao] that $[\omega^{\underline{t}}]$ is ample if and only if $pt_\tau > t_{\sigma^{-1}\tau}$ for all τ. The necessity is proved in their using a description of certain Goren-Oort strata, building on a prior work of [Helm]. In this talk, we recall their results and prove this ampleness criterion. I will also talk about its generalizations to the flag space over some unitary Shimura varieties.

    Reference:
    [Tian-Xiao], On Goren-Oort stratification for quaternionic Shimura varieties, Compositio Mathematica, 2016.
    [Helm], A geometric Jacquet-Langlands correspondence for $U(2)$ Shimura varieties, Isreal Journal of Mathematics, 2012.
    [Yang], Ampleness of automorphic line bundles on $U(2)$ Shimura varieties.

Xinyi Yuan (Peking University)

Title: Recent development of uniform Mordell conjecture
Abstract: This talk will introduce some recent progresses on the uniform Mordell conjecture over global fields by Dimitrov-Gao-Habegger, Kuhn, Yuan, Looper-Silverman-Wilms, and Yu.

Bin Zhao (Capital Normal University）

Title: Slopes of modular forms and geometry of eigencurves
Abstract: In this talk, I will report my recent joint work with Ruochuan Liu, Nha Xuan Truong and Liang Xiao on the ghost conjecture, which gives an effective algorithm to compute the p-adic slopes of certain eigenforms. I will then explain the applications of our work to the study of Galois representations and eigencurves. If time allows, I will also discuss the potential generalizations of ghost conjecture.