

Workshop on Hodge Theory 2024

Conference Manual



August 15 - 23, 2024

USTC · Hefei

目录

注意事项	3
会议日程	4
课程和报告摘要	6
短期课程	6
前沿报告	8
附录一、校园地图（东校区）	11

注意事项

欢迎您参加 The Workshop on Hodge Theory 2024. 请您注意如下信息：

1. 注册：签到和领取会议手册可以选择如下其中一个时间（本次会议无胸牌）：
 - 1) 8月15日下午16:00-18:30，到会场签到领取会议手册和餐卷等物品，晚餐可以去教工餐厅吃饭；
 - 2) 8月16日早上8:20-8:40到会场签到和领取相关物品。
2. 课程和报告会场均在东校区第二教学楼2105教室，具体位置参见附录校园地图的标注。
3. 用餐地点位于东校区师生活动中心3楼教工餐厅，具体位置参见附录校园地图的标注。8月18日18:30将于专家楼举办晚宴，专家楼地点见附录校园地图。
4. 交通：
 - 1) 到达合肥南站，可乘坐地铁5号线到中国科大东区下(共5站)，或打车(约7公里)。
 - 2) 到达合肥火车站，可乘坐地铁3号线到海棠转5号线到中国科大东区下(共9站)，或乘坐公交车1或226路，到中国科技大学下；打车约8公里。
 - 3) 到达合肥新桥机场，可乘坐机场巴士1号线至大西门然后打车到中科大东校区，或直接打车(约40公里)。
5. 酒店：
 - 1) 专家楼，位于中科大东区内，见附录校园地图。
 - 2) 江南春酒店，位于中科大东校区旁边，金寨路和太湖路交叉口东北角，见附录校园地图。
 - 3) 亚朵酒店，位于中科大东校区旁边，黄山路金寨路交叉口向西250米路北，见附录校园地图。

如果您需要帮助，请联系：

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会议日程

会场位于中科大东校区第二教学楼 2105 教室

时间\日期	8. 16	8. 17	8. 18	8. 19	8. 20	8. 21	8. 22	8. 23
8:45(*)	开幕式							
9:00-10:30	沈明民	沈明民	李志远	李志远	李时璋	李时璋	陈家明	自由讨论
10:30		合影						
10:50-11:50	王博潼 (学术报告)	杨梓谕 (学术报告)	李志远	李志远	李时璋	李时璋	陈家明	
	午餐（教工餐厅**）							
14:30-16:00	李念梓	李念梓	自由讨论	魏传豪	魏传豪	陈家明	陈家明 (学术报告)	离会
16:10-17:40	李念梓	李念梓		魏传豪	郝峰 (学术报告)	陈家明		
	晚餐（教工餐厅）		晚宴 (专家楼**)	晚餐（教工餐厅）				
19:00-20:00				傅列 (学术报告)	吴磊 (线上学术报告)			
21:00-22:00		郭浩洋 (线上学术报告)						

注：*) 8 月 16 日 8：20-8：40 为签到时间，如果您 8 月 15 日未签到，请于此时间到达会场签到

**) 教工餐厅与专家楼的地点，请见附录地图标记。

	时间	报告人	主题
8. 16	08:40—		开幕
	09:00—10:30	沈明民	Around the integral Hodge conjecture, I
	10:50—11:50	王博潼 (学术报告)	Linear Singer-Hopf conjecture
	14:30—16:00	李念梓	Non-abelian Hodge correspondence for tame harmonic bundles, I
	16:10—17:40	李念梓	Non-abelian Hodge correspondence for tame harmonic bundles, II
8. 17	09:00—10:30	沈明民	Around the integral Hodge conjecture, II
	10:30—10:50	合影	
	10:50—11:50	杨梓诠 (学术报告)	Pointwise good reduction criteria for local systems, I
	14:30—16:00	李念梓	Non-abelian Hodge correspondence for tame harmonic bundles, III
	16:10—17:40	李念梓	Non-abelian Hodge correspondence for tame harmonic bundles, IV
	21:00—22:00	郭浩洋 (线上学术报告)	Pointwise good reduction criteria for local systems, II
8. 18	09:00—10:30	李志远	Introduction to hyper-Kahler varieties over arbitrary fields, I
	10:50—11:50	李志远	Introduction to hyper-Kahler varieties over arbitrary fields, II
	18:30—	晚宴 (专家楼)	
8. 19	09:00—10:30	李志远	Introduction to hyper-Kahler varieties over arbitrary fields, III
	10:50—11:50	李志远	Introduction to hyper-Kahler varieties over arbitrary fields, IV
	14:30—16:00	魏传豪	Twistor D-modules in a nutshell, I
	16:10—17:40	魏传豪	Twistor D-modules in a nutshell, II
	19:00—20:00	傅列 (学术报告)	Motive of moduli spaces
8. 20	09:00—10:30	李时璋	Algebro-geometric glimpse of p-adic Hodge theory, I
	10:50—11:50	李时璋	Algebro-geometric glimpse of p-adic Hodge theory, II

	14:30—16:00	魏传豪	Twistor D-modules in a nutshell, III
	16:10—17:40	郝峰 (学术报告)	On Smooth Projective Manifolds with Topological Circle Bundle Structures
	19:00—20:00	吴磊 (线上学术报告)	D-modules, motivic integrals and hypersurface singularities
8. 21	09:00—10:30	李时璋	Algebro-geometric glimpse of p-adic Hodge theory, III
	10:50—11:50	李时璋	Algebro-geometric glimpse of p-adic Hodge theory, IV
	14:30—16:00	陈家明	Applications of o-minimality to Hodge theory, I
	16:10—17:40	陈家明	Applications of o-minimality to Hodge theory, II
8. 22	09:00—10:30	陈家明	Applications of o-minimality to Hodge theory, III
	10:50—11:50	陈家明	Applications of o-minimality to Hodge theory, IV
	14:30—16:00	陈家明 (学术报告)	Convex Fujita numbers

课程和报告摘要

短期课程

Title: Applications of o-minimality to Hodge theory

Speaker: 陈家明 (Goethe University Frankfurt)

Abstract: This short course aims to introduce recent advancements in Hodge theory through the lens of o-minimality. We will begin with an overview of the fundamentals of o-minimal geometry, followed by an exploration of its various applications within Hodge theory:

- (i) the definability of period maps and the algebraicity of images of period maps;
- (ii) functional transcendence;
- (iii) distribution of Hodge loci.

Title: Non-abelian Hodge correspondence for tame harmonic bundles

Speaker: 李念梓 (清华大学丘成桐数学中心)

Abstract: The nonabelian Hodge correspondence identifies the following objects from different areas: Higgs bundles, harmonic bundles, and representations of the

fundamental group. In this minicourse, we will explain Simpson's work on this correspondence for harmonic bundles over a punctured Riemann surface, satisfying a growth condition called tameness.

1. Simpson's main estimate
2. Filtered objects
3. Existence of harmonic metrics
4. Non-abelian Hodge correspondence

Title: Algebro-geometric glimpse of p-adic Hodge theory

Speaker: 李时璋 (中国科学院)

Abstract: 我们将尽量以代数几何工作者的观点出发, 介绍一些 p 进 Hodge 理论中的构造与结果, 力求让初学者对如下话题祛魅:

- (1) Hodge-Tate decomposition;
- (2) Fontaine's period rings;
- (3) Scholze's perfectoid spaces.

Title: Introduction to hyper-Kähler varieties over arbitrary fields

Speaker: 李志远 (复旦大学)

Abstract: Lecture I: Introduction to hyper-Kähler geometry

Lecture II: Fundamentals of hyper-Kähler varieties

Lecture III: Hodge conjecture and Tate conjecture on hyper-Kähler varieties

In this lecture series, I shall present an introductory overview of hyper-Kähler geometry, with a focus on the following topics:

- 1) Basic of hyper-Kähler (HK) varieties: definition of HK varieties over arbitrary field, construction of HK varieties of known type,
- 2) Global Torelli theorem of hyper-Kähler manifolds: computations of the monodromy groups
- 3) Sheaves and algebraic cycles on hyper-Kähler: discussion of hyperholomorphic sheaves, recent progress on Hodge conjecture and Tate conjecture for known types.

Title: Around the integral Hodge conjecture

Speaker: 沈明民 (University of Amsterdam)

Abstract: In this mini-course, I will explain a few counterexamples to the integral Hodge conjecture (IHC). Then I will explain how the IHC connects with unramified cohomology and the rationality problem.

Title: Twistor D-modules in a nutshell

Speaker: 魏传豪 (西湖大学)

Abstract: In this minicourse, I will give a quick tour of Sabbah and Mochizuki's theory of mixed Twistor D-modules. In the first part, I will introduce the theory of R-modules,

basic functors on R -modules, and sesquilinear pairing on R -modules as a singular version of Harmonic metric. In the second part, I will give the definition of mixed Twistor D -modules, and list some fundamental theorems in this theory. If time permits, I will introduce some applications in algebraic geometry.

前沿报告

Title: D -modules, motivic integrals and hypersurface singularities

Speaker: 吴磊 (浙江大学)

Abstract: This talk is an invitation to the study of monodromy conjecture for hypersurfaces in complex affine spaces. I will recall two different ways to understand singularities of hypersurfaces in complex affine spaces. The first one is to use D -modules to define the b -function (also known as the Bernstein-Sato polynomial) of a polynomial (defining the hypersurface). The other one uses motivic integrals and resolution of singularities to obtain the motivic/topological zeta function of the hypersurface. The monodromy conjecture predicts that these two ways of understanding hypersurface singularities are related. Then I will discuss some known cases of the conjecture for hyperplane arrangements. There will be plenty of examples.

Title: On Smooth Projective Manifolds with Topological Circle Bundle Structures

Speaker: 郝峰 (山东大学)

Abstract: One of Yau's conjectures (ICCM 2013) says that canonically polarized complex projective manifolds do not admit nontrivial topological S^1 -actions. In this talk, I will give a discussion on projective manifolds with topological S^1 -actions, and show that canonically polarized complex projective manifolds do not admit free topological S^1 -actions if their Albanese varieties are simple.

Title: Pointwise good reduction criteria for local systems, I

Speaker: 杨梓诠 (香港中文大学)

Abstract: Let S be a connected smooth rigid analytic variety over a p -adic field K and let T be a p -adic local system over S . There are two fundamental results which tell us when T is de Rham: Scholze proved that the relative p -adic cohomology of a smooth and proper family over S is de Rham. Liu and Zhu proved that if T is de Rham at one classical point, then T is so everywhere.

In this first talk of a series of two, I will present a recent work with Haoyang Guo which aims to extend the above results to crystalline and semi-stable local systems. Our approach focuses on identifying the correct analogue of Liu-Zhu's theorem. Namely, if S admits a smooth (resp. semi-stable) integral model, then T is crystalline (resp. semi-stable) provided that it is so at "sufficiently many" classical points. Then I will explain how this can be used to extend Scholze's theorem.

Title: Pointwise good reduction criteria for local systems, II

Speaker: 郭浩洋 (University of Chicago)

Abstract: In this talk, we will build on Yang's presentation and explain the strategy and key components used to prove the pointwise criteria for both ℓ -adic and p -adic local systems.

Title: Motive of moduli spaces of bundles on curves

Speaker: 傅列 (Université de Strasbourg)

Abstract: Motive of moduli spaces of bundles on curves

Abstract: I will survey old results and recent progress on the study of cohomology and motive of various moduli stacks and moduli spaces of vector bundles on curves with additional structures (e.g. Higgs field, parabolic structure). Some results mentioned in the talk are obtained in collaboration with Hoskins and Pepin-Lehalleur.

Title: Convex Fujita numbers

Speaker: 陈家明 (Goethe University Frankfurt)

Abstract: I will discuss joint work with Küronya, Mustopa, and Stix on the effective global generation of adjoint line bundles on smooth projective varieties. To measure effectiveness, we introduce the concept of the convex Fujita number of a smooth projective variety. I will present several examples and explore its relation to fundamental groups.

Title: Linear Singer-Hopf conjecture

Speaker: 王博潼 (北京大学, University of Wisconsin-Madison)

Abstract: If X is a closed aspherical manifold of dimension $2d$, the Singer-Hopf conjecture predicts that $(-1)^d \chi(X) \geq 0$. We prove this conjecture for projective manifolds whose fundamental groups admit an almost faithful linear representation. In fact, we prove a stronger statement that all perverse sheaves on X has nonnegative Euler characteristics. The main ingredients of the proof are non-abelian Hodge theories both in the archimedean and non-archimedean setting and a vanishing cycle functor for multi-valued one forms. This is joint work with Ya Deng.

组织者

(按姓氏拼音排序)

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