

Workshop on p-adic Geometry (18–22 Nov 2024)

Organizing Committee

Wee Teck Gan

David Hansen

National University of Singapore



Venue

18 to 21 Nov

LT34

Block S17 Level 3,
10 Lower Kent Ridge Road
Singapore 119706

22 Nov

LT32

Science Drive 3
Singapore 117542



This workshop is partially sponsored by
the GS Charity Foundation.

感谢旭日慈善基金对本次学术研讨会的慷慨资助

For more information:

<https://ims.nus.edu.sg/events/p-adicgeometry/>

Workshop on p-adic Geometry

(18 Nov – 22 Nov 2024)

Monday, 18 November 2024

Time	Title	Speaker
0900–0930	Registration	
0930–1030	p-adic Trace and (generalized) Poincare Duality (Talk 1)	Shizhang Li <i>Morningside Center of Mathematics, China</i>
1030–1100	Tea Break	
1100–1200	p-adic Trace and (generalized) Poincare Duality (Part 2)	Shizhang Li <i>Morningside Center of Mathematics, China</i>
1200–1400	Lunch Break	
1400–1500	Emerton's Factorization of Completed Cohomology (Part 1)	Pierre Colmez <i>Institut de Mathématiques de Jussieu, France</i>
1500–1530	Tea Break	
1530–1630	Emerton's Factorization of Completed Cohomology (Part 2)	Pierre Colmez <i>Institut de Mathématiques de Jussieu, France</i>

Tuesday, 19 November 2024

Time	Title	Speaker
0915–0930	Registration	
0930–1030	p-adic Trace and (generalized) Poincare Duality (Part 3)	Shizhang Li <i>Morningside Center of Mathematics, China</i>
1030–1100	Group Photo & Tea Break	
1100–1200	p-adic Trace and (generalized) Poincare Duality (Part 4)	Shizhang Li <i>Morningside Center of Mathematics, China</i>
1200–1400	Lunch Break	
1400–1500	Emerton's Factorization of Completed Cohomology (Part 3)	Pierre Colmez <i>Institut de Mathématiques de Jussieu, France</i>
1500–1530	Tea Break	

Workshop on p-adic Geometry

Tuesday, 19 November 2024		
Time	Title	Speaker
1530–1630	Emerton’s Factorization of Completed Cohomology (Part 4)	Pierre Colmez <i>Institut de Mathématiques de Jussieu, France</i>
Wednesday, 20 November 2024		
Time	Title	Speaker
0915–0930	Registration	
0930–1030	Six-functor Formalisms and Categorical Langlands (Part 1)	Lucas Mann <i>University of Münster, Germany</i>
1030–1100	Tea Break	
1100–1200	Six-functor Formalisms and Categorical Langlands (Part 2)	Lucas Mann <i>University of Münster, Germany</i>
1200–1400	Lunch Break	
1400–1500	Co-Whittaker Families for Quasi-split Groups	David Helm <i>Imperial College London, UK</i>
1500–1530	Tea Break	
1530–1630	Cohomology of Log Prismatic F-crystals	Teruhisa Koshikawa <i>RIMS, Kyoto University, Japan</i>
1630–1645	Tea Break	
1645–1745	Pointwise Criterion for p-adic Local Systems	Ziquan Yang <i>Chinese University of Hong Kong, Hong Kong SAR</i>
Thursday, 21 November 2024		
Time	Title	Speaker
0915–0930	Registration	
0930–1030	Duality Theorems in p-adic Analytic Geometry (Part 1)	Wiesława Nizioł <i>Institut de Mathématiques de Jussieu, France</i>
1030–1100	Tea Break	
1100–1200	Duality Theorems in p-adic Analytic Geometry (Part 2)	Wiesława Nizioł <i>Institut de Mathématiques de Jussieu, France</i>
1200–1400	Lunch Break	
1400–1500	Six-functor Formalisms and Categorical Langlands (Part 3)	Lucas Mann <i>University of Münster, Germany</i>
1500–1530	Tea Break	

Workshop on p-adic Geometry

Thursday, 21 November 2024		
Time	Title	Speaker
1530–1630	Six-functor Formalisms and Categorical Langlands (Part 4)	Lucas Mann <i>University of Münster, Germany</i>
Friday, 22 November 2024		
Time	Title	Speaker
0915–0930	Registration	
0930–1030	Duality Theorems in p-adic Analytic Geometry (Part 1)	Wiesława Nizioł <i>Institut de Mathématiques de Jussieu, France</i>
1030–1100	Tea Break	
1100–1200	Duality Theorems in p-adic Analytic Geometry (Part 2)	Wiesława Nizioł <i>Institut de Mathématiques de Jussieu, France</i>

This schedule is accurate as of 04 Nov 2024 and is subjected to changes.

EMERTONS FACTORIZATION OF COMPLETED COHOMOLOGY

PIERRE COLMEZ
INSTITUT DE MATHÉMATIQUES DE JUSSIEU

I will report on our joint work with Shanwen Wang on the factorization of the Beilinson-Kato system as a product of two modular symbols. Emphasis will be put on a new proof of Emerton's factorization of the completed cohomology of the tower of modular curves.

CO-WHITTAKER FAMILIES FOR QUASI-SPLIT GROUPS

DAVID HELM
IMPERIAL COLLEGE LONDON

In his tensor factorization of the completed cohomology of the modular tower (with Z_p -coefficients), Emerton observed that the local factors corresponding to primes ℓ different from p could be uniquely characterized, up to isomorphism, by a short list of properties relating such a factor to the associated local Galois representation (in particular, such factors satisfied a form of Ihara's lemma and agreed generically with the representations of GL_2 associated to the local Galois representation via local Langlands.) In later joint work Emerton and I proved that, given an n -dimensional local Galois representation, there was at most one family of representations of GL_n over the same base that satisfied a similar set of desiderata; such families were later shown to always exist by joint work of mine with Gil Moss.

We show that an analogous construction can be made for any quasi-split group over a local field F , and explain a (conjectural) connection between this construction and the categorical local Langlands correspondence.

This is joint work with Jean-Francois Dat, Rob Kurinczuk, and Gil Moss.

COHOMOLOGY OF LOG PRISMATIC F-CRYSTALS

TERUHISA KOSHIKAWA
RIMS, KYOTO UNIVERSITY

After the foundations of Bhatt-Scholze, Bhatt-Lurie, and Drinfeld, the relative cohomology of prismatic F-crystals (and F-gauges) has been studied extensively, e.g., in the works of Guo-Reinecke and Guo-Li. I will present my current understanding of the logarithmic version. This is based mainly on my earlier work with Zijian Yao and ongoing work with Kentaro Inoue.

P-ADIC TRACE AND (GENERALIZED) POINCARÉ DUALITY

SHIZHANG LI
MORNINGSIDE CENTER OF MATHEMATICS

I will give a quick tour guide to my recent preprint written with Emanuel Reinecke and Bogdan Zavyalov, which treats a relative Poincaré duality statement for proper morphisms between rigid spaces over mixed characteristic nonarchimedean fields (previously conjectured by Bhatt–Hansen).

Detailed plan for each talk is as follows.

Talk 1: We shall see main statements and some background history on étale cohomology of rigid spaces.

Talk 2: We shall explain how Poincaré duality and preservation of lisse local systems under higher pushforward along a smooth proper morphism of analytic locally Noetherian adic spaces can be obtained once we have cycle class + trace map satisfying expected axioms.

Talk 3: In this talk we will explain how to construct trace maps (with appropriately Tate-twisted and shifted constant coefficients) for arbitrary equi-dimension d smooth morphisms between analytic locally Noetherian adic spaces, which satisfies expected axioms.

Talk 4: We shall explain how the trace constructed in the previous talk can be used to define trace maps (this time with dualizing complexes, as defined by Bhatt–Hansen, being our coefficients) for arbitrary proper morphisms between rigid spaces over mixed characteristic nonarchimedean fields. This construction actually leads to a proof of the aforementioned conjecture by Bhatt–Hansen.

SIX-FUNCTOR FORMALISMS AND CATEGORICAL LANGLANDS

LUCAS MANN
UNIVERSITY OF MÜNSTER

Six functor formalisms are a great tool to organize the data that go into a cohomology theory, like étale, singular or coherent cohomology, thereby streamlining and abstracting many arguments and constructions that work in any (reasonable) such theory. In recent years it has become apparent that 6-functor formalisms have a much richer abstract theory than one might think at first, and that this theory in particular provides important finiteness conditions on sheaves in a cohomology theory. In this minicourse we will discuss the definition of 6-functor formalisms and the attached finiteness conditions on sheaves. We will then discuss how these notions manifest in specific examples, including smooth representations of locally profinite groups.

By applying the theory to Fargues-Scholze's stack Bun_G of G -bundles on the Fargues-Fontaine curve, we will gain new insights on the expected categorical local Langlands correspondence, especially its behavior with respect to various dualities. We then use this knowledge to sketch a proof of the categorical Langlands conjecture for $\mathrm{GL}_2(\mathbb{Q}_p)$. Much of this material is based on joint works with David Hansen and with Claudius Heyer.

DUALITY THEOREMS IN P-ADIC ANALYTIC GEOMETRY

WIESŁAWA NIZIOŁ
INSTITUT DE MATHÉMATIQUES DE JUSSIEU

I will discuss duality theorems for p-adic geometric pro-étale cohomology of partially proper rigid analytic varieties. The first two talks will address the dualities on the Fargues-Fontaine curve by reducing them to coherent dualities, the remaining two – will descend these dualities to the world of Topological Vector Spaces. This is a joint work with Pierre Colmez and Sally Gilles.

POINTWISE CRITERION FOR P-ADIC LOCAL SYSTEMS

ZIQUAN YANG
CHINESE UNIVERSITY OF HONG KONG

Let S be a connected smooth rigid analytic variety over a p -adic field K , and let V be a p -adic local system over S . A celebrated theorem of Liu and Zhu states that if V is de Rham at one classical point, then V is globally de Rham. When S has good reduction over the ring of integers of K , one naturally asks about analogous statements when we replace "de Rham" with "crystalline" or "semi-stable." It is well known that the naive analogues are false. In joint work with Haoyang Guo, we prove that Liu-Zhu's result can be remedied if one tests at "sufficiently many" points when a good integral model for S is chosen. In particular, if V is crystalline or semi-stable at every classical point, then it is crystalline or semi-stable. Since Haoyang has already given a talk on this topic at a conference at the University of Chicago, and the recording is available on YouTube, I will avoid excessive overlap with his presentation, which focuses more on applications, and instead discuss the actual proof of the result.