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## Introductory courses on the stable trace formula, with emphasis on $SL(2)$

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### ABSTRACT

My objective for the mini-course is to get a working understanding of the terms involved in the Arthur-Selberg trace formula using the example of  $SL(2)$ . Starting with the co-compact case I will analyze Arthur's truncated kernel for  $SL(2)$ . I will analyze the terms in the coarse and fine geometric and spectral expansions that arise from this truncated kernel. I end with the invariant trace formula and Kaletha will continue with the discussion of the stable trace formula. I will closely follow the excellent notes by Prof. Arthur in the Clay volume.

# Introductory courses on the approach of Braverman-Kazhdan-Ngo to L-functions

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## ABSTRACT

In this series of lectures, we will discuss Braverman-Kazhdan-Ngo's conjectural framework for an explicit construction of local L-factors over local fields of characteristic 0. In particular, we start with the local Langlands functoriality principle, briefly survey the theory of Algebraic Monoid, and then give an introduction on Braverman-Kazhdan-Ngo's proposal.

# A base change fundamental lemma via the geometry of shtukas

TONY FENG

*Stanford University, USA*

## ABSTRACT

We will explain a geometric approach to the base change fundamental lemma over function fields, which is based on ideas of Ngo Bao Chau. The approach works by comparing the cohomology groups of moduli spaces of shtukas, which we will introduce.

# On the stable transfer factor for the symmetric square lifting from $GL_2$ to $GL_3$

DANIEL JOHNSTONE

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## ABSTRACT

I will discuss work in progress towards an explicit computation of the stable transfer factor for the symmetric square lifting from  $GL_2(F)$  to  $GL_3(F)$  for  $F$  a  $p$ -adic field. This is joint work with Zhilin Luo.

# Low degree cohomologies of congruence groups

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## ABSTRACT

We prove the vanishing of certain low degree cohomologies of some induced representations. As an application, we determine certain low degree cohomologies of congruence groups. Basic theory of continuous cohomologies, and Franke's filtration of the space of automorphic forms will be reviewed. This is a joint work with Jian-Shu Li.

# On depth in the local Langlands correspondence

MASAO OI

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## ABSTRACT

Let  $G$  be a classical group over a  $p$ -adic field  $F$ . Then the local Langlands correspondence gives a natural correspondence between the irreducible smooth representations of  $G(F)$  and  $L$ -parameters of  $G$ . It is believed that this correspondence satisfies a lot of good properties beyond its characterization. One of such phenomena is the depth preserving property. We can define the notion of the depth, which is a numerical invariant, for both of irreducible representations and  $L$ -parameters. Then it is expected that the local Langlands correspondence preserves these invariants at least in a large residual characteristic. In this talk, I will give a partial answer to this problem by investigating the endoscopic character relation, which is the characterization of the local Langlands correspondence for classical groups.

# The Drinfeld-Gaitsgory operator on automorphic functions

JONATHAN WANG

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## ABSTRACT

Let  $F$  be a function field and  $G$  a connected split reductive group over  $F$ . We define a “strange” operator between different spaces of automorphic functions on  $G(\mathbb{A})/G(F)$ , and show that this operator is natural from the viewpoint of the geometric Langlands program via the functions-sheaves dictionary. We discuss how to define this operator over a number field by relating it to pseudo-Eisenstein series and inversion of the standard intertwining operator. This operator is also connected to Deligne-Lusztig duality and cohomological duality of representations over a local field.