# Workshop on
# Local Langlands Conjecture and Galois Representations
## December 16-27, 2013

### Titles & Abstracts

**Speaker**: Ashay Burangale

**Date & time:** Tuesday, 17 December, 2013 at 2.30-3.30 p.m.

**Title** : $\mathfrak{p}$-rigidity and Iwasawa $\mu$-invariants.

**Abstract** : Let $F$ be a totally real field with ring of integers $O$ and $p$ be an odd prime unramified in $F$. Let $\mathfrak{p}$ be a prime above $p$. A mod $p$ Hilbert modular form associated to $F$ is determined by its restriction to the partial Serre-Tate deformation space $\widehat{\mathbb{G}}_m \otimes O_{\mathfrak{p}}$. We give a brief overview of this $\mathfrak{p}$-rigidity and its application to the $\mu$-invariant of certain anticyclotomic $\mathfrak{p}$-adic $L$- functions (joint work with Prof. H. Hida).

**Speaker**: Gautam Borisagar

**Date & time:** Wednesday, 18 December, 2013 at 2.30-3.30 p.m.

**Title** : Iwahori-Hecke model for supersingular representations of $\mathrm{GL}_2(\mathbb{Q}_p)$.

**Abstract** : We first recall the fundamental work of Barthel, Livne and Breuil on the mod $p$ representation theory of $\mathrm{GL}_2(\mathbb{Q}_p)$ and then present a variant of their approach in which a supersingular representation of $\mathrm{GL}_2(\mathbb{Q}_p)$ is realized as a quotient of a representation induced from the Iwahori subgroup, instead of the maximal compact subgroup. Certain computations appear to be easier to execute via this model. We briefly illustrate an instance of this by obtaining the $K$-socle filtration of a supersingular representation. This latter result is originally due to Stefano Morra.

**Speaker**: Pierre Colmez

**Date & time:** Thursday, 19 December, 2013 at 4.00-5.00 p.m. Colloquium.

**Title** : Modular forms and $p$-adic representations

**Abstract** : The $p$-adic local Langlands correspondence for $\mathrm{GL}_2(\mathbf{Q}_p)$ attaches a $p$-adic representation $\Pi$ of $\mathrm{GL}_2(\mathbf{Q}_p)$ to each 2-dimensionnal representation $V$ of the absolute Galois group of $\mathbf{Q}_p$. If $V$ comes from a modular form $f$ of weight $k$, one can read on $\Pi$ the (locally constant) representation of $\mathrm{GL}_2(\mathbf{Q}_p)$ obtained by letting $\mathrm{GL}_2(\mathbf{Q})$ act on $f$ (compatibility between the classical and $p$-adic local Langlands coreespondences): the recipe is quite simple if $k \geq 2$, but more subtle if $k = 1$.

**Speaker**: Narasimha Kumar

**Date & time:** Friday, 20 December 2013 at 2.30-3.30 p.m.

**Title** : On sign changes of $q$-exponents of generalized modular functions.

**Abstract** : Let $f$ be a generalized modular function ($GMF$) of weight 0 and level $N$, such that its $q$-exponents $c(n)$ ($n \geq 1$) are all real, and $\mathrm{div}(f) = 0$. We show the equidistribution of signs for $c(p)$ ($p$ prime), by using equidistribution theorems for normalized cuspidal eigenforms of integral weight.

**Speaker**: Pierre Colmez

**Date & time:** Monday, 23 December, 2013 at 2.30-3.30 p.m. (Colloquium)

**Title** : Locally analytic representations of $\mathrm{GL}_2$.

**Abstract** : I will explain how the $p$-adic local Langlands corespondence for $\mathrm{GL}_2(\mathbf{Q}_p)$ can be extended to a correspondence from 2-dimensionnal $(\varphi, \Gamma)$-modules over the Robba ring to locally analytic representations of $\mathrm{GL}_2(\mathbf{Q}_p)$ (one recovers the $p$-adic local Langlands correspondence by restricting the result to étale $(\varphi, \Gamma)$-modules: these are in correspondence with 2-dimensionnal representations of the absolute Galois group of $\mathbf{Q}_p$ via Fontaine's equivalence of categories and its variants). Part of the construction extends to finite extensions of $\mathbf{Q}_p$.

**Speaker** : U.K. Anandavardhanan

**Date & time:** Tuesday, 24 December, 2013 at 2.30-3.30 p.m.

**Title** : Self-extensions of supersingular representations of $\mathrm{GL}_2(\mathbb{Q}_p)$

**Abstract** : We recall the work of Paskunas on extensions between supersingular representations of $\mathrm{GL}_2(\mathbb{Q}_p)$ and indicate an approach to this question via compact induction from the Iwahori subgroup.

**Speaker** : Debargha Banerjee

**Date & time:** Thursday, 26 December, 2013 at 2.30-3.30 p.m.

**Title** : Differential modular forms on Shimura curves over totally real fields.

**Abstract** : If we start with mod $p$ modular forms, they may or may not have lifts to characteristic zero modular forms. Buium introduced differential modular forms in a new geometry.In this new geometry, modular forms modulo $p$ always have lifts to characteristic zero modular forms. In this talk, we will introduce the theory of differential modular forms for compact Shimura curves over totally real fields. These are the modular forms obtained by applying the arithmetic jet space functors (adjoint to the Witt vector functors) to the ring of modular forms. We show that these differential modular forms help us to detect the ordinary quaternionic abelian schemes and schemes with Frobenius lifts (local analogue of CM abelian schemes). These are also useful to understand the categorical quotients of Shimura curves modulo Hecke correspondences and isogenies.

**Speaker**: Laurent Berger

**Date & time:** Friday, 27 December, 2013 at 2.30-3.30 p.m.

**Title** : Mod $p$ representations of the Borel subgroup of $\mathrm{GL}_2(\mathbb{Q}_p)$.

**Abstract** : The study of the mod $p$ local Langlands program for $\mathrm{GL}_2(\mathbb{Q}_p)$ has shown the importance of the "restriction to $\mathrm{B}_2(\mathbb{Q}_p)$ (the upper-triangular Borel subgroup)" functor. In this lecture, I will give a complete classification of the mod $p$ representations of $\mathrm{B}_2(\mathbb{Q}_p)$ (joint work with Mathieu Vienney).

**Speaker**: Przemyslaw Chojecki

**Date & time: TBA**

**Title** : Ordinary representations (after Breuil-Herzig).

**Abstract** : We show and discuss a construction due to Breuil and Herzig of a $p$-adic local Langlands correspondence for higher dimensional groups which works for ordinary upper-triangular representations.

**Speaker**: Marie-France Vigneras

**Date & time: TBA**

**Title** : The pro-$p$-Iwahori Hecke algebra I, II

**Abstract I** : Let $I(1)$ be the pro-$p$-Sylow of an Iwahori subgroup of $G$. We describe the alcove walks basis of the $k$-algebra $H$ of $G$-intertwiners of $k[G/I(1)]$, the product formula that they satisfy, the center of $H$, and finiteness results.

**Abstract II**: We describe the inverse Satake homomorphism from $H$ to spherical algebras and the supersingular modules of $H$.