UCLA NUMBER THEORY LEARNING SEMINAR, SPRING 2023

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1. Suggested References

The primary reference for this seminar will be Hong's p-adic Hodge theory notes.

2. Order of Talks

(1) **Finite flat group schemes, Frobenius.** - Recollections on group schemes, in particular algebraic groups and elliptic curves, basic theory, and Frobenii. This should cover roughly section 1 of Hong.
(2) ***p*-divisible groups.** - This talk will introduce p-divisible groups, basic properties, and connections to Dieudonne modules, following section 2, chp 2 of Hong.
(3) **Hodge–Tate Decomposition I.** - The first of two talks introducing the Hodge-Tate decomposition, motivated from complex geometry, following roughly Hong II.3.1-II.3.3, focused on introducing formal groups and the p-adic logarithm
(4) **Hodge–Tate Decomposition II.** - Continuing last weeks talk, this week we will finish section II.3 of Hong's notes, discussing the Hodge–Tate decomposition for Tate modules, and generic fibers of p-divisible groups.
(5) **Fontaine's Formalism and Period Rings.** - This talk introduces period rings, Fontaine's resolution to Grothendieck's conjecture about the Grothendieck mysterious functor, following section III.1 of Hong.
(6) **de Rham representations.** - Following Hong III.2, we introduce de Rham representations, the first kind of representations related to period rings which we will be interested in.
(7) **Crystalline representations.** This week, we discuss so-called crystalline representations and finish the discussion of Grothendieck's conjecture, roughly following Hong III.3.
(8) **Geometric structure of the Fargues–Fontaine curve.** We turn our attention to the Fargues-Fontaine curve again, discussing its geometric properties as in Hong IV.2
(9) **Vector bundles on the Fargues–Fontaine curve I: .** Following Hong IV.3.1-IV.3.4, we introduce the theory of vector bundles on the Fargues-Fontaine curve, one of the main tools in modern p-adic Hodge theory.
(10) **Vector bundles on the Fargues–Fontaine curve II: Applications.** In the final talk, we conclude the discussion on the properties of vector bundles on the Fargues-Fontaine curve, and connect them back to p-adic representations to give various applications, following Hong IV.3.5-IV.4.2.

Date: March 2023.