ARithmetische Geometrie OberSeminar

Bonn, Wintersemester 2012

Programmvorschlag: M. Rapoport

Topic: Formal moduli spaces in equal characteristic

The aim of the seminar is to understand the analogue in the equal characteristic case of the theory developed in the monograph [14]. More precisely, we want to understand the analogues of p-divisible groups, of Dieudonné theory, of the formal moduli spaces of p-divisible groups, and of period spaces.

0. Talk: Introduction (M. Rapoport)

Presentation of the subject of the seminar. Distribution of talks.

1. Talk: Definition of z-divisible modules

Explain the different roles of z and ζ, cf. [6], 1.2. Explain *finite strict* $\mathbb{F}_q$*-modules* and their relation to finite $\mathbb{F}_q$-shtukas, cf. [12], §1; comp. also [1] and [2], §2 (where, however, the strictness refers to the structure of $\mathcal{O}$-module!). Give Examples, e.g. [6], 3.4, and [9]. Explain notion of *z-divisible groups* (alias *divisible Anderson modules*), cf. [12], Def. 2.3.3

2. Talk: Local shtukas

Give definitions, cf. [3, 12, 6] (also of *effective*, resp. *minuscule* local shtukas). Explain the equivalence between the stacks of z-divisible groups and of certain local shtukas, cf. [7], §6, [12], 2.4.

3. Talk: Dieudonné-Manin Classification of isocrystals over an algebraically closed field

Explain the notion of isocrystal in this context (cf. [6], 3.5), and give the proof of [13], Thm. 2.4.5.

4. Talk: The Grothendieck-Messing theorem for minuscule local shtukas

Explain this theorem in its simplest version, when $I^q = (0)$, cf. [7], §11. Give an overview of the truly crystalline version of [3], §§5, 6.

5. Talk: Local G-shtukas

Explain the notion in [4], §3 (leave out the proof of Soergel's theorem there). Make the connection to the previous talks, cf. [4], §4. Give the example of the Picard case of signature (r, s).

6. Talk: RZ-spaces and affine Deligne-Lusztig varieties

Explain the contents of [4], §6.

7. Talk: Filtered isocrystals

Explain the notion of *Hodge-Pink structure*, cf. [6], 3.7, [5], §2. Explain the mysterious functor construction, cf. [6], 5.5.

8. Talk: Period spaces

Explain some of the contents of [5], §3, comp. [6], §6, including the jet spaces occurring naturally in the general case; also explain why they don't appear in the minuscule case. For the period morphism outside the minuscule case, the analogy with the unequal characteristic case breaks down partially, compare [10], below 2.5, and [11].

References

[1] V. Abrashkin, *Galois modules arising from Faltings's strict modules*, Compos. math. **142** (2006), no. 4, 867–888.

[2] G. Faltings, *Group schemes with strict O-action*, Mosc. Math. J. **2** (2002), no. 2, 249-279.

[3] A. Genestier, V. Lafforgue, *Théorie de Fontaine en égales caractéristiques* Ann. Sci. Éc. Norm. Supér. (4) **44** (2011), no. 2, 263-360.

[4] U. Hartl, E. Viehmann *The Newton stratification on deformations of local G-shtukas*, J. Reine Angew. Math. **656** (2011), 87-129.

[5] U. Hartl, *Period spaces for Hodge structures in equal characteristic* Ann. of Math. (2) **173** (2011), no. 3, 1241-1358.

[6] U. Hartl, *A dictionary between Fontaine-theory and its analogue in equal characteristic* J. Number Theory **129** (2009), no. 7, 1734-1757.

[7] U. Hartl, *Local Shtuka and Divisible Local Anderson Modules* (2006) preprint

[8] U. Hartl, *Uniformizing the stacks of abelian sheaves*, Number fields and function fields-two parallel worlds, 167-222, Progr. Math., **239**, Birkhäuser Boston, Boston, MA, 2005.

[9] U. Hartl, e-mails to Rapoport (2012)

[10] U. Hartl, E. Hellmann, *The universal family of semi-stable p-adic Galois representations*, in preparation.

[11] T. Schlauch, in preparation.

[12] R. Kumar Singh, *Local Shtukas and Divisible Local Anderson-Modules* (2012) preprint

[13] G. Laumon, Cohomology of Drinfeld modular varieties. Part I. Geometry, counting of points and local harmonic analysis. Cambridge Studies in Advanced Mathematics, **41**. Cambridge University Press, Cambridge, 1996. xiv+344 pp.

[14] M. Rapoport, Th. Zink, Period spaces for p-divisible groups. Annals of Mathematics Studies, 141. Princeton University Press, Princeton, NJ, 1996. xxii+324 pp.