

## SCIENTIFIC REPORT

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REF: 4253

VISIT: Univ Paris13 – From 08/06/2011 to 22/06/2011

### **Purpose of the visit:**

There were two main purposes of my visit to Paris:

- *Motivic Cohomology*: Discussing with F. Déglise about some topics of motivic cohomology. In particular an idea to prove a generalized version of an equivariant Riemann-Roch-Grothendieck theorem in the setting of Voevodsky's derived category of mixed motives  $DM(S)$ , meanwhile attending the "Ecole d'été: Proof of Milnor's Conjecture".
- *General Relativity*: Discussing with and J. Navarro about the recent advances in the proof of Lovelock's theorem of Relativity and discussing

### **Work carried out during the visit:**

From 9th of June until the 16th I attended daily four lectures around Voevodsky's proof of the Milnor's conjecture. The rest of the time I worked mainly with F. Déglise around a proof of an equivariant Riemann-Roch-Grothendieck theorem for the Voevodsky's derived category of mixed motives  $DM(S)$ , with J. Navarro around a generalization of the Lovelock's theorem in General Relativity and a recently new idea we had for proving duality theorems in an algebraic geometry setting.

### **Descriptions of the main results obtained:**

*General Relativity*: Classical Lovelock's theorem classifies natural second order twice covariant tensors on pseudo-Riemannian manifolds which are symmetric and divergence-free. We succeed removing the symmetric hypothesis.

*Duality Theorems*: We think we succeed giving a new proof on Cartier duality, neutral Tannakian duality for affine group schemes and the equivalence between formal groups and Lie algebras in characteristic zero.

### **Future collaboration with host institution.**

This september F. Déglise is moving to the ENS Lyon. Therefore in october I will visit the ENS Lyon to visit again F. Déglise to keep working on the Riemann-Roch-Grothendieck theorem.

On the other hand, C. Soulé will be in charge of a seminar at the IHES around the motivic cohomology. Dates are still unknown but it is expected to start no later than october. Both J. Navarro and me intend to attend that seminar.

### **Projected publications/articles resulting.**

*Lovelock's theorems*: A short note will be written and submitted for publication regarding the proof without the symmetric hypothesis.

*Duality theorems*: A paper is currently under work. However, writing this one will take longer and further problems may appear meanwhile.

### **Other comments**

None.