

# READING AND WORKING ON ALGEBRAIC STACKS

Sara Mehidi, Zakaria Ouaras, Amira Tlemsani

This is a seminar on algebraic stacks: the main reference is Olsson's book **Algebraic spaces and stacks** (cf. [2]). We start with two introductory sessions on algebraic geometry, covering the main points of the first two chapters of [2]. Each session after that will be followed by exercises chosen by the speaker. For the Deligne-Mumford stacks (last session), we will also refer to the original paper of Deligne-Mumford on the subject (cf. [1]).

Session 1 (Background 1/2).

Session 2 (Background 2/2).

Session 3 (Fibered categories 1/2) Definition of fibered category and basic properties; the 2-Yoneda lemma + exercises.

Session 4 (Fibered categories 2/2) Splittings of fibered categories; categories fibered in groupoids + exercises.

Session 5 (Descent and the stack condition 1/2) Faithfully flat descent; generalities on descent; descent for quasi-coherent sheaves; examples + exercises.

Session 6 (Descent and the stack condition 2/2) More examples; stacks; applications: torsors and principal homogeneous spaces; + exercises.

Session 7 (Algebraic spaces 1/2) Properties of sheaves and definition of algebraic space; algebraic spaces and sheaf quotient + exercises.

Session 8 (Algebraic spaces 2/2) Examples of algebraic spaces; Basic properties of algebraic spaces; algebraic spaces are fppf sheaves + exercises.

Session 9 (Algebraic stacks: definitions and basic properties 1/2) Definition of algebraic stack and fiber products; properties of algebraic stacks and morphisms between them + exercises.

Session 10 (Algebraic stacks: definitions and basic properties 2/2) Deligne-Mumford stacks; examples + exercises.

## References

- [1] Pierre Deligne and David Mumford. The irreducibility of the space of curves of given genus. *Publications mathématiques de l'IHÉS*, 36, 01 1969.
- [2] Martin Olsson. *Algebraic spaces and stacks*, volume 62 of *American Mathematical Society Colloquium Publications*. American Mathematical Society, Providence, RI, 2016.