

Advanced Algebraic Geometry

Lecture by Dr. Helge Ruddat, Mo, We 8:30-10:00, exercises We 14-16

We want to learn about the foundational concepts of *schemes* and *sheaves* and their ability to connect geometry, algebra and number theory. While a variety is defined over an algebraically closed field, a scheme is defined over an arbitrary (commutative) ring. This allows to treat concepts like tangent vectors, jets, prime numbers, Galois actions, algebraic limits and intersection multiplicities all within a universal framework. The material we are going to cover will comprise of

- Sheaves and operations on them,
- Locally ringed spaces, Spec, schemes, morphisms, gluing, fibre products,
- Toric varieties: the link between integral real affine and algebraic geometry,
- Proj and blowups,
- Flat families, algebraic limits, first order deformations, properness.

Basic prior knowledge of affine and projective varieties as well as commutative algebra will be helpful.

Two sessions of 90min of lecture per week are complemented by another 90min of exercises.

Literature

1. D. Eisenbud; J. Harris: *The Geometry of Schemes*, Graduate Texts in Mathematics 197, Springer, 1997.
2. W. Fulton: *Introduction to Toric Varieties*, Annals of Mathematics Studies 131, Princeton University Press, Princeton, NJ, 1993.
3. R. Hartshorne: *Algebraic Geometry*, New York: Springer-Verlag, 1977; corrected 6th printing, 1993.