Mathematics 535. Lie Theory II: Algebraic Groups

MWF 2-2:50, January - April 2025.

MATH (Mathematics Building), room 204.

Instructor: Zinovy Reichstein

Textbook: Lie groups and algebraic groups A. L. Onishchik, E. B. Vinberg, Springer-Verlag, 1990. ISBN: 3-540-50614-4.

Available on line through UBC library.

Subject description: The theory of algebraic groups is the study of symmetry and motion in the context of algebra and algebraic geometry. It plays an important role in the construction of moduli spaces in algebraic geometry, in the Langlands program, and in the classification of finite simple groups.

The course will focus on affine algebraic groups over an algebraically closed field of characteristic 0. I will start by reviewing preliminary material from algebraic geometry, to homogeneous spaces, the Jordan decomposition, solvable groups, the ineplay between an algebraic group and its Lie algebra, Borel and parabolic subgroups and the structure of reductive and semisimple groups.

Course description: The book by Onishchik and Vinberg is clearly and efficiently written and is considered more accessible than other textbooks on algebraic groups. I will mostly follow it, with two caveats. One is that this book treats Lie groups and algebraic groups in parallel. My main focus will be on algebraic groups and algebro-geometric techniques. Another unusual feature of this book is that it presents a lot of the technical results in the form of problems. I will work through some of those in class, and leave some for homework assignments.

Homework: There will be no exams in this class. I plan to assign a problem set every 2-3 weeks. Interaction and collaboration on homework is encouraged, but the work you turn in should be your own, written in your own words.

Further information will be provided on Canvas.