

## TOPICS IN ALGEBRAIC GEOMETRY AND GEOMETRIC REPRESENTATION THEORY, MATH 615

- Course: Math 615A (Topics in algebraic geometry and geometric representation theory), Term 2, 2015-2016.
- Instructor: Sabin Cautis, Math 116, [cautis@math.ubc.ca](mailto:cautis@math.ubc.ca)
- Time: TuTh, 11-12:30
- Location: IBLC Room 460
- Course website: <http://www.math.ubc.ca/~cautis/math615/>

**Synopsis:** Geometric representation theory is a beautiful subject that applies techniques from algebraic geometry to questions in representation theory (and vice versa) while touching on topics in algebra, combinatorics and, more recently, categorification.

The course will focus on understanding the geometry and representation theory behind classical geometric objects such as Grassmannians and flag varieties as well as behind algebraic ones such as Hecke algebras. The motivating example we start with is the Beilinson-Lusztig-MacPherson geometric construction of quantum  $\mathfrak{sl}_2$ . We use this as an opportunity to learn, along the way, some basic theory behind categories of constructible sheaves and coherent sheaves and some simple tools in categorification.

**Textbook:** There is no required textbook but I will be teaching to some degree out of:

- “Representation theory and complex geometry” by Chriss and Ginzburg,
- “Sheaves on manifolds” by Kashiwara and Schapira,
- “Fourier Mukai transforms in algebraic geometry” by Huybrechts.

**Background:** This course is a bit eclectic but it would be helpful to have some background in algebraic geometry or algebraic topology (homology and vector bundles in particular). Otherwise some background in representation theory would help you approach the subject from this angle.

**Homework:** There will be several assignments to help absorb the material and presentations at the end of the course.