LIE GROUPS AND THEIR REPRESENTATIONS

Time and Location: TTh, 11:00-12:30, Mathematics 102.

Instructor: Julia Gordon
Office: 217 Math Bldg
Phone: 822-0569
e-mail: gor@math.ubc.ca
Course homepage: www.math.ubc.ca/~gor/lie535.html
Office hours: TBA

Textbook: We will continue with Fulton-Harris for a while, and then switch to multiple other sources (mainly, a copy of the out-of-print text "Lie groups and algebraic groups" by Vinberg and Onischik, and online course notes by D. Vogan), that will be distributed in class.

Course description. This course is a continuation of the Lie theory sequence; it will be dedicated largely to algebraic groups, and complex and real Lie groups.

We will pick up essentially where math 534 ended: we will briefly review Dynkin diagrams and classification of complex simple Lie algebras. The goal there would be to get comfortable with root systems. Then we will proceed to classify complex Lie groups (for this we'll have to look at root and coroot lattices). The next step would be the definition of an *algebraic* group, and the discussion of algebraic groups over arbitrary (not necessarily algebraically closed) fields. Then real Lie groups will appear as real forms of complex Lie groups. In fact, the field of real numbers is quite special in this context, because it turns out that every complex algebraic group has exactly one compact real form. We will learn about some wonderful implications of this fact.

Then we will discuss the representation theory of compact Lie groups, and cover standard tools such as Weyl character formula. Time permitting, we'll survey some representation theory of not necessarily compact Lie groups.

Throughout the course, we will emphasize algebraic methods; it should be quite useful to have some familiarity with these methods for those who are interested in Lie theory from the geometric, or even differential equations, point of view. On then other hand, this is basically required material for those who are interested in Automorphic Forms. No prior knowledge of algebraic geometry will be assumed.

Background expectations. The only prerequisite is Math 534 or some equivalent background.

Marking. The mark will be based entirely on class participation and homework. There will also be small projects that one can pick from, to present in class. Interaction and collaboration on homework is encouraged.