

**LIE GROUPS AND DISCRETE SUBGROUPS, SYMMETRIC AND
LOCALLY SYMMETRIC SPACES
7.5 HP**

1. COURSE DESCRIPTION

Lie groups, and generally algebraic groups, are fundamental algebraic subjects. Symmetric spaces are quotient of Lie groups and their further quotients by discrete subgroups are locally symmetric spaces; they are generalization of Euclidean spaces and uniformization spaces of various geometries. Many of the current developments in mathematics, such as Langlands program and automorphic forms, are based on harmonic analysis on locally symmetric spaces.

This course is (a) to introduce general theory of Lie algebras and Lie groups, (b) to cover the classification theory of semisimple complex Lie algebras and root systems and Dynkin Diagrams, and (c) to study elementary theory of algebraic groups and their discrete subgroups. (d) to introduce some important symmetric spaces, locally symmetric spaces and discrete subgroups, and related open research problems.

2. AIM OF THE COURSE

After finishing the course the students should (1) understand the algebraic structure of some fundamental classes of Lie groups such as nilpotent and semisimple Lie groups, (2) master the basic techniques in classification of reflection groups and root systems, and (3) be able to construct some examples of discrete subgroups by using the reflection groups and algebraic groups.

3. DURATION

The course will be in LP3, the academic year 2018-19, with two lectures per week two hours each.

4. PREREQUISITES

Basic knowledge of abstract algebra, real analysis, functional analysis and elementary differential geometry.

5. LECTURERS AND COURSE ORGANIZER

Genkai Zhang, genkai@chalmers.se

6. LECTURES AND EXAMINATION

Lecture twice a week two hours each. There will be home assignments during the lectures. At the end of the course there will be presentations by the participants and oral examination.

7. LITTEATURE

J. Humphreys, Introduction to Lie Algebras and Representation Theory, Springer-Verlag.

S. Helgason, Differential Geometry, Lie groups and Symmetric spaces. Academic Press.

G. Margulis, Discrete subgroups of Lie Groups. Springer-Verlag.

D. Morris, Introduction to Arithmetic groups.

8. REGISTRATION

Please send email to the course organiser for registration.