Lie groups
Seminar SoSem 2018

Lie groups are "smooth" groups, i.e. they are simultaneoulsy groups and smooth manifolds. Both structures are compatible in the sense that the group operations are differentiable. Important examples are matrix groups like the general linear groups $GL(n, \mathbb{R})$, the special linear groups $SL(n, \mathbb{R})$ and the orthogonal groups $O(n)$. Lie groups arise as continuous symmetries and were discovered in the 19th century by the norwegian mathematician Sophus Lie when he investigated the symmetries of differential equations and developed a "differential" Galois theory. They play now a basic role in most areas of mathematics and physics.

In the seminar, we will discuss the following topics:

- examples of classical Lie groups, in particular spin and Lorentz groups

- correspondence between Lie groups and Lie algebras

- basic structure of Lie algebras

- representations of semisimple Lie groups

References: V.S. Varadarajan, *Lie groups, Lie algebras, and their representations*, Graduate Texts in Mathematics 102, Springer, 1984.
B.C. Hall, *Lie groups, Lie algebras, and representations: An elementary introduction*, Graduate Texts in Mathematics 222, Springer 2003,
M.R. Sepanski, *Compact Lie groups*, Graduate Texts in Mathematics 235, Springer, 2007.

Prerequisites: Basic knowledge of differentiable manifolds.

For: Students of mathematics or physics (Bachelor, Master, TMP, Lehramt).

Language: German and/or english, depending on the participants.

Preliminary meeting: Tuesday **april 10** at **14:15h** in room **B 252**

If you are interested in participating, please write email or come to the preliminary meeting. (It helps for the planning to know as soon as possible who will take part!!) The second meeting (on wednesday april 18) will be used to recapitulate basics on Lie groups from the differentiable manifolds point of view as discussed in my course last semester. The talks by the students will start afterwards, on april 25.