U·H Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

CHAMPP
CENTER IN HAMBURG FOR
ASTRO-, MATHEMATICAL AND
PARTICLE PHYSICS

LECTURE COURSE IN THE QUANTUM UNIVERSE RESEARCH SCHOOL

Winter Term 2021/2022

Lie Algebras

Paul Wedrich

Course Description:

This course will give an introduction to Lie algebras and their representation theory, with a focus on the complex semisimple case. A Lie algebra is a vector space equipped with a (typically) non-associative multiplication called Lie bracket. Lie algebras arise naturally in many contexts in mathematics and physics, for example as tangent spaces at the identity of Lie groups, and they can be thought of as spaces of "infinitesimal" or "linearised symmetries".

The content of the course includes:
- the definition and basic properties of Lie algebras;
- the classical Lie algebras, including a thorough discussion of $\mathfrak{sl}(2, \mathbb{C})$ early in the semester;
- the classification problem, nilpotent and solvable Lie algebras;
- semisimple Lie algebras, root systems;
- representation theory of semisimple Lie algebras;
- universal enveloping algebra and PBW theorem;
- an outlook on applications.

This course is mainly aimed at Masters and advanced Bachelor students in Mathematics and Mathematical Physics.

Prerequisites:

Basic notions from algebra (groups, fields, linear algebra).

Date and Place:	Mon, 12:15–13:45, Hörsaal H6, Geomatikum
	Thu, 12:15–13:45, Hörsaal H5, Geomatikum
Problem Classes:	Group 1: Mon, 16:15–17:45, online (access via STiNE)
	Group 2: Thu, 14:15–15:45, SR 434, Geomatikum
Starting on:	11 October 2021