SYLLABUS

Lie Groups and Lie Algebras

22 Feb 2022 to 11 Jun 2022
Mondays 8:00 a.m.- 10:45 a.m.
Week 1-16

By **Prof. Tudor Stefan Ratiu**

    Chinese Government Friendship Award (2020)

    Fellow of European Academy of Sciences (2019)

    Shanghai Magnolia Memorial Award　(2018)

    Tullio Levi-Civita for the Mathematical and Mechanical Sciences Award

    American Mathematical Society Fellow (2012)

    Russian Megagrant Winner (2011)

Credits: 3

Course Outline：

PART 1: Lie Algebras (8 topics, each taught for two weeks)

The four infinite series of classical simple complex Lie algebras

Nilpotent and solvable Lie algebras, fundamental theorems

Semisimple Lie algebras

Representation theory for SL(2,C)

Root space decomposition

Abstract root spaces and their properties

Weyl group, simple roots, order relation, Weyl chambers

Classification via Dynkin diagrams

PART 2: Lie Groups (8 topics, each taught for two weeks)

Review of basic calculus on manifolds. Definition of Lie groups. Examples.

The Lie algebra. The exponential map. The three adjoint actions

Baker-Campbell-Hausdorff, Lie's First Fundamental Theorem

Lie subgroups, Lie group homomorphisms, link to exponential map

Classification of connected Abelian Lie groups

Connected component of the identity. Simply connected Lie groups

Lie's Second Fundamental Theorem

Lie's Third Fundamental Theorem, informal discussion