

## ▼ Introduction

### ▼ underlying principle: linear algebra is easy

#### ▼ should try: nonlinear structure -> linear structure (matrices)

- represent group elements by matrices
- replace Lie groups (continuous group) by Lie algebras (infinitesimal model)

#### ▼ diagonalize matrices -> eigenvalues

- character of representations
- root system

### ▼ concrete goals

#### ▼ linear representation of finite groups

- complete reducibility
- character of representation
- # conjugacy classes = # irreducible representations

#### ▼ Lie algebras

- solvable and semisimple Lie algebras
- representation of  $SL_2$

#### ▼ root system of simple Lie algebras

- classification by Dynkin diagrams

### ▼ where does it lead to?

#### ▼ Tannaka-Krein duality

- representation -> tensor categories

#### ▼ interplay between geometry of the flag manifold and representation

- algebro-geometric and geometric structures

#### ▼ harmonic analysis

- noncompact groups
- functional analytic and algebraic structures

#### ▼ infinite dimensional Lie groups / algebras

- loop groups, Kac-Moody algebras
- vector fields, deformation quantization