

## Lecture 2, Sep 13, 2021

- Scientific method: Observations induce hypothesis, hypothesis deduce prediction, prediction tests observations
  - Induction makes generalizations, deductions applies the hypothesis to specific cases
  - Hypothesis is a combination of a model and assumptions
- Physical laws arise from symmetries:
  1. Time invariance: Is physics different “now” compared to “then”?
    - Energy conservation  $\iff$  time invariance
  2. Spatial invariance: Is physics different “here” compared to “there”?
    - Momentum conservation  $\iff$  spatial invariance
  3. Rotational invariance: Is physics different from “this perspective” compared to a rotated perspective?
    - Angular momentum conservation  $\iff$  rotational invariance
- Noether’s theorem: Each symmetry corresponds to a conservation law
- Quantities such as  $m$  are typically in italics, and units such as m are typically in roman