HEP-GR (2025-2026), Part I

Lecture: Mehrdad Mirbabayi, LB 286, mirbabayi@ictp.it

Tutorial: Johann Quenta, LB 288, jquentar@sissa.it

1. Textbook

Landau-Lifshitz, *Weinberg*, and *Wald*. A more geometrical approach can be found in *Carroll*, and *Misner-Thorn-Wheeler*.

2. Evaluation

There will be a homework set every week due at the beginning of the tutorial session. The final grade (G) is determined from the final Exam (EX) and Homework (HW). Homework will only contribute positively:

$$\text{If} \quad HW > EX \Rightarrow G = 0.6EX + 0.4HW, \qquad \text{otherwise} \quad G = EX,$$

3. Tentative Plan

1. Special Relativity, Electromagnetism
   - 1.1 Poincaré Symmetry
   - 1.2 Relativistic Kinematics
   - 1.3 Maxwell Theory, Variational Principle
   - 1.4 Symmetries and Conservation Laws, Noether Theorem
2. Relativistic Theory of Gravitation (Linear)
   - 2.1 Spin, Representation Theory of Poincaré Group
   - 2.2 Scalar Gravity
   - 2.3 Phenomenology of Scalar Gravity, and its Failure
   - 2.4 Spin-2 Gravity (Linearized)
   - 2.5 Gravitational Waves

3. Relativistic Theory of Gravitation (Nonlinear)

    3.1 General Covariance

    3.2 Einstein-Hilbert Action

    3.3 Differential Geometry