Quantum Gravity and the Renormalization Group

Assignment 4 – Nov 09

Exercise 8: Approaches to Quantum Gravity

Motivation: To get a small overview of the field of Quantum Gravity, we will discuss some specific approaches and how they (aim to) solve the predictivity problem of perturbative renormalisation. The different approaches are expected to give rise to different physical effects. However, it is not yet understood whether they really do, because most quantum-gravity approaches are quite involved and it is very difficult to extract physical predictions. In addition, because the Planck scale is so far removed from scales that experiments can probe directly, it is difficult to check any predictions.

Read up on one (or more, if you like) approach to Quantum Gravity. What is the respective starting point/idea? How would it solve the issue that in a perturbative quantisation, predictivity breaks down? Is predictivity restored? If so, how? What is the current state of the approach, and what are the major open questions? Pick out of these approaches:

- String Theory
- Loop Quantum Gravity
- Causal Set Theory
- Causal Dynamical Triangulations
- Group Field Theory

Do **not** pick Asymptotic Safety — this will be discussed during this course!