

Supervisor: Raçon Adam

Topic: quantum field theory

Amplitude-phase representation in the path integral formalism

The objective of this internship is to study the phase-amplitude representation in path integral, to put it on a more solid foundation. The path integral formalism, introduced by Feynman, allows us to write the probability amplitude of a quantum process as a sum over all possible paths. It has strong connections with stochastic processes (Brownian motion, stock market fluctuations, etc.), and it is well known that the standard rules of calculus do not always apply. This encodes the non-commutativity of the operator in the standard formulation of quantum mechanics.

The modern formulation of the theory of condensed matter uses a generalization of the path integral formalism using coherent states, which allows for describing the physics of quantum systems at all scales. A particularly useful version uses a non-linear transformation of the quantum fields, using an amplitude-phase representation. It however needs to be put on a more solid foundation, which is the goal of the internship.

The first part of the internship will be an introduction to the path integral formalism and its subtlety, while the second part will focus on the amplitude-phase representation in this setting.