# 1 Project phases

To achieve the aim of the project, that is to study the properties of quantum particles in a fractal external potential, we are going to use three different methods, that can be seen as individual studies (exact diagonalization, random walks and Gross-Pitaevskii equation). To develop each method, we will have the following phases:

* Previous study (PS)
* Design (DN)
* Implementation (IM)
* Data analysis (DA)

# 2 Tasks description

As I mentioned on the previous section, each of the three methods that we are using is going to follow the phases previously specified. As this is a research project and we do not really know a priori the results that we are going to obtain, we might be changing the order of the tasks.

Each task is assigned a different key code to identify it easily.

## Project management

Here I specify the tasks that are found in every kind of project that are related with the management of this one. Some of them are done during GEP, such as the definition of the scope, the planification, the budget and the sustainability of this project.

The others are executed during the hole project. For example, we planned a weekly meeting with the thesis supervisor to coordinate our work and so he could explain me his ideas about the current state of project and comment some possible improvements or clarifications about it. In this task there is also included the continuous emails we send each other during the week for possible doubts or some daily details about the progress of my work.

As this is a research project that can possibly end as a scientific publication, we must strictly justify every step we take and keep track of the methodology we are following. This is done within the documentation task, which will we be done during the hole project as we will update the documentation on every action we perform.

Scope (T1)

Planification (T2)

Budget (T3)

Sustainability (T4)

Meetings (T5)

Documentation (T6)

## 2.2 Exact diagonalization

This method is applied to one particle and to a many-body system composed of fermions. The following tasks consist on the study of the Schrödinger equation and the design of how it can be solved for these systems. The implementation of this design is the following step, and all of this leads us to the possibility of obtaining the energetic and structural properties of these systems, such as the ground state energy. With all these data, we can study the relation it has with the external potential that we applied.

Previous study (T7)

Design (T8)

Implementation (T9)

Data analysis (T10)

## 2.3 Random walks

* Previous study (T11)
* Design (T12)
* Implementation (T13)
* Data analysis (T14)

## 2.4 Gross-Pitaevskii equation

* Previous study (T15)
* Design (T16)
* Implementation (T17)
* Data analysis (T18)