LABORATOIRE DE PHYSIQUE ET
MODELISATION DES MILIEUX CONDENSES –UMR 5493

Master internship proposal

Topic: **Measurement and control of the Hamiltonians of quantum computers.**

Group: Laboratoire de Physique et Modélisation des Milieux Condensés (LPMMC), Grenoble

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Summary

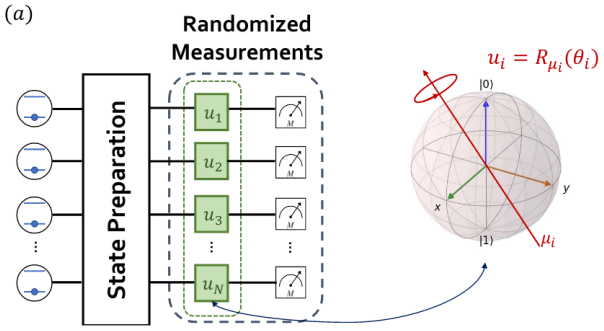
Quantum computers are usually used in terms of quantum circuits that are made of single and two qubit gates. The underlying physical processes are described by time-dependent Hamiltonians acting on one/two qubits [1].

The goal of this internship is to characterize such Hamiltonians, and also to explore the possibility to generate Hamiltonians that act on a larger number of qubits. This is of interest both for quantum computing applications (multi qubit gates), and quantum simulation (understanding condensed matter problems described by many-body Hamiltonians).

Our team has an expertise in measurement protocols, I.e we can measure physical properties associated with a quantum state that is formed on a quantum computer . During the internship, we will use the randomized measurement toolbox [2] to understand how to measure and control the Hamiltonian of a quantum device.

We will perform the experimental part of the work on IBM quantum computers. In order to create the relevant experimental data, we will use the Qiskit library Pulse. This allows one to drive the qubits of IBM quantum computers, and make them interact in order to generate a tunable Hamiltonian. We will then use our measurement toolbox to measure this Hamiltonian, as well as the effects of decoherence.

The internship may be followed by a PhD.



References

[1] https://journals.aps.org/prxquantum/pdf/10.1103/PRXQuantum.2.040336

[2] https://arxiv.org/abs/2203.11374