

INTERNATIONAL RELATIONS



INTERNSHIP SUBJECT

2893 - Improvement of the quantum Grover algorithm for active user detection

Quantum physics emerged in the 20th century to describe the workings of atoms and particles. This discipline was particularly popularized by Einstein in his studies on relativity.

Since then, this quantum approach has also found its way into the world of telecommunications and computer science (quantum information science). In this field, quantum effects are considered and exploited to transmit or manipulate information. In fact, quantum algorithms can significantly speed up the resolution of typical problems, such as searching for an element satisfying one or more criteria (database search, selection of the optimum solution for demodulation or routing, etc.). In particular, these algorithms are envisaged to help detect active users in a signal, and enable Grant Free access to the channel.

To this end, specific codes are assigned to each user, representing his or her signature. The challenge is to detect each user's activity in real time. We have already considered the use of Grover's algorithm to perform active user detection.

But many questions remain unanswered, the algorithms used for detection can still be improved. The student selected for this internship will be looking at GAS (Grover Adaptive Search) algorithms, a family of quantum exhaustive search algorithms designed to solve binary optimization problems. This family is based on the Grover algorithm, one of the best-known quantum algorithms. The objective is to study how the initialisation of this algorithm can help further accelerate the processing.

- 1- (Basic) understanding of quantum phenomena
- 2- Understanding Grover's algorithm
- 3- Reading proposed articles and selecting approaches
- 4- Simulating and testing new initialisation approaches

The idea behind this project can be to give a head start on the quantum subject, which is set to become increasingly important over the next few years. This internship is also possible if you have no background on quantum algorithm nor quantum physics.

Required Skills

- 1- good knowledge on Python programming
- 2- either knowledge on wireless communications or quantum algorithms (if you have none, it will be too difficult)

Dates are indicative. They can be adapted.

General Information

- **Research Theme :** Networks and Telecommunications
- **Locality :** Villeurbanne
- **Level :** Master
- **Period :** 5th January 2026 -> 31st March 2026 (3 months)

 *These are approximative dates. Please contact the training supervisor to know the precise period.*

- **Deadline to apply :** 1st July 2025 (midnight)

Contacts

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More information

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